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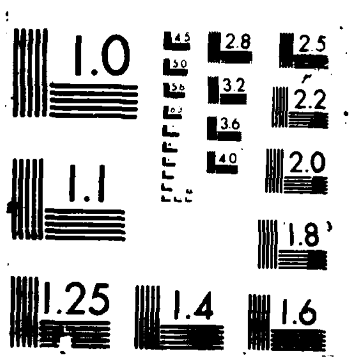
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POTENTIAL INFORMATION AND DECISION
SUPPORT SYSTEM APPLICATIONS FOR A
CIVIL ENGINEERING RED HORSE SQUADRON

THESIS

Arvil E. White III
Captain, USAF

AFIT/GEM/LSM/87S-27

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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AFIT/GEM/LSM/87S-27

POTENTIAL INFORMATION AND DECISION SUPPORT SYSTEM APPLICATIONS FOR A CIVIL ENGINEERING RED HORSE SQUADRON

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Engineering Management

Arvil E. White III, B.S.M.E.

Captain, USAF

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Preface

The purpose of this study was to determine applications for automated management systems in Civil Engineering RED HORSE squadrons, and to make recommendations for the development and implementation of these systems. Extensive interviews with RED HORSE squadron personnel, and various systems analysis methodologies presented in the current literature, provided the basis for this research effort.

The length of this report suggests that I provide advice for those attempting to read and understand this report. Readers not familiar with RED HORSE squadrons and their recent automation efforts should find the background information in Chapter 1, the findings of Chapter 4, and the descriptive models of Chapter 5 helpful in understanding the RED HORSE squadron environment and problems managers face with their current manual information systems. System designers should carefully review Appendix D and Chapter 7 for more detailed descriptions of MIS and DSS applications and the system capabilities required to support them.

This research and the preparation of this thesis could not have been accomplished without the help of others. I am deeply indebted to the many individuals in the 820th and 823rd RED HORSE squadrons who patiently endured my interviews, and provided the data for this research. I also thank my faculty advisor, Major Hal Rumsey and my thesis reader, Capt John Morrill for their continuing patience and

assistance during this effort. Finally, I wish to thank my wife Sheila for her understanding and motivational support throughout this difficult year.

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Abstract

The development of automated management systems for USAF Civil Engineering Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer (RED HORSE) squadrons has lagged behind other Air Force Engineering and Services organizations. The low level of automation in these squadrons may be due in part to the differences in the way they operate and a lack of understanding of their automated management system needs. This study defines the automation needs of RED HORSE squadrons, and identifies various Management Information System (MIS) and Decision Support System (DSS) applications, by analyzing the decision-making information needs of managers in these squadrons.

The results of interviews with managers in two RED HORSE squadrons, as well as a review of regulations and policy material, provided the data for this study. Data and Decision Analysis techniques were used to determine the decision-making information needs of various managers in the squadron. Descriptive and normative models of key decision processes were used to identify potential MIS/DSS application areas. Key decisions were analyzed to identify the automated system capabilities required to support these decisions. Finally, a risk assessment of the system implementation environment was used to identify potential

barriers to the effective implementation of automated systems in a RED HORSE squadron.

The research findings indicate the primary MIS applications are reports of personnel, equipment, and vehicle availability; training schedules; project status; and readiness status to the different managers involved in the two major squadron activities--accomplishing troop training projects, and maintaining combat readiness. Several DSS applications are recommended to provide managers with support in scheduling training projects, scheduling individuals for training and project deployments, and forecasting funds or material requirements. A six-step implementation strategy is also presented to improve user acceptance and facilitate the integration of applications between users.

POTENTIAL INFORMATION AND DECISION SUPPORT SYSTEM
APPLICATIONS FOR A CIVIL ENGINEERING
RED HORSE SQUADRON

I. Introduction

Within Air Force Civil Engineering, the Civil Engineering Rapid Engineer Deployable, Heavy Operations Squadron, Engineers (RED HORSE) are 400-man squadrons which provide a combat engineering construction capability to support the USAF mission worldwide. In peacetime, these squadrons accomplish heavy construction and repair projects at different bases to maintain proficiency in their wartime skills. The vast resources of these squadrons and their tremendous construction capability require that the managers in these organizations make the best possible decisions in allocating squadron resources. Effective Decision Support Systems (DSS) and Management Information Systems (MIS) can greatly enhance the quality of these decisions.

As part of the effort to improve the efficiency and effectiveness of Air Force Civil Engineering units, the Air Force is introducing the Work Information Management System (WIMS) in all Base Civil Engineering (BCE) Squadrons (15). These systems utilize a WANG mini-computer network system to support application software developed by the USAF. RED HORSE squadrons have been the target of similar automation attempts, but with less success. While the squadrons have obtained small micro-computer systems, the automation requirements of these squadrons are not adequately defined.

Justification for Study

RED HORSE Squadrons have a different mission and operate differently from Base Civil Engineering Squadrons. Compared with the BCE squadrons, RED HORSE squadrons have little experience with computers. Prior to the introduction of WIMS, most BCE squadrons operated with BEAMS (Base Engineer Automated Management System). Because of this, the use of computers in BCE squadrons may be more institutionalized. RED HORSE Squadrons, on the other hand, have not used BEAMS. They have relied on manual information systems best characterized by bulky files and wall hung "grease boards".

RED HORSE squadrons implementing computer systems must identify and design useful applications before the intended benefits and objectives of any automation program can be realized. This thesis research effort is directed towards helping RED HORSE squadrons develop automation applications by examining their information needs and providing recommendations based on an analysis of those needs.

Background

"RED HORSE squadrons provide a highly mobile, rapidly deployable civil engineering response force that is self-sufficient for limited periods of time" (17:6). To support wartime and peacetime contingencies, RED HORSE squadron personnel and equipment resources are assigned to specialized mobility teams. The composition of these teams is described in Air Force Regulation 93-9, Civil Engineering RED HORSE Squadrons. During peacetime, these squadrons conduct specialized personnel training in various areas, such as chemical warfare, Rapid Runway Repair (RRR), explosives demolition, special weapons, expedient methods, and security training (17:26-30). Squadrons also conduct periodic deployment exercises in the field. Troop training projects provide valuable peacetime proficiency training for the craftsmen assigned to the squadron. Personnel are deployed to other bases to do construction and heavy repair projects. Because of these activities, the environment in the squadron is characterized by a constantly fluctuating work force, as people and equipment move from one project or exercise to another. To accomplish its mission, each squadron is divided into four main branches. An organizational chart for a typical RED HORSE squadron is shown in Figure 1.

The Engineering Branch contains the Engineering Design and Site Development/Drafting sections. They provide engineering field support; conduct field surveys, site selection, and base layout; and perform quality control inspection and material testing (17:16).

RED HORSE SQUADRON ORGANIZATION

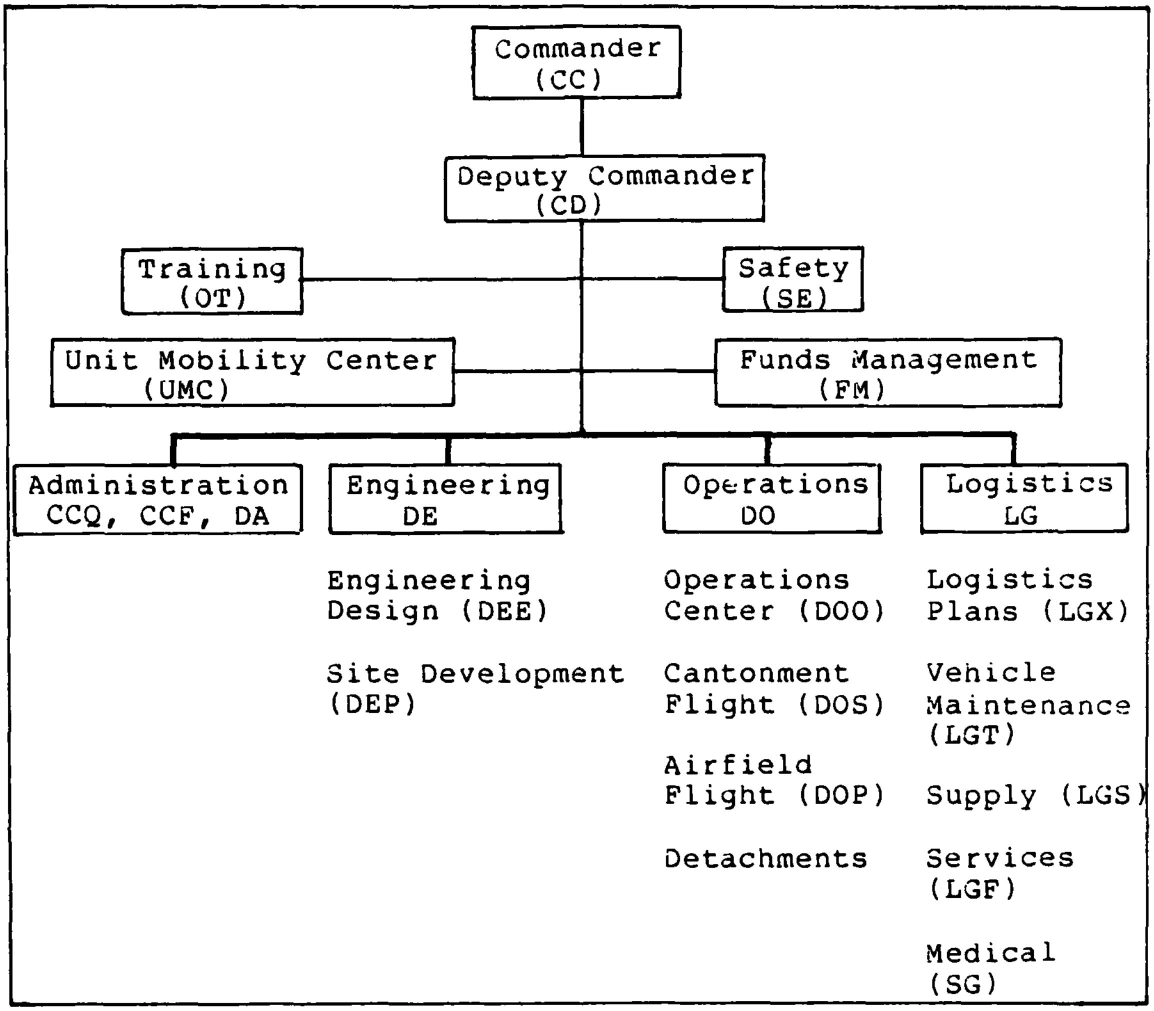

Figure 1. Organizational Chart (17:17)

The Logistics Branch contains Vehicle Maintenance, Supply, Services, and Logistics Plans sections. It provides all logistics support, including maintenance of all vehicles and equipment; storage, control, and issue of all materials, clothing, and weapons; operation and maintenance of field messing and laundry services; medical care; and the preparation and maintenance of squadron mobility plans (17:18-19).

The Operations Branch contains the Operations Center, Cantonment Flight (vertical skills) and Airfields Flight (horizontal skills). The Operations Center schedules and monitors all RED HORSE work projects and deployments. The Cantonment and Airfields Flights provide the craftsmen or workforce to accomplish vertical and horizontal construction, including utility systems, paving, well drilling, and explosive demolition operations (17:17-18).

The Administrative Branch includes the Squadron Section Commander, First Sergeant, and Squadron Orderly Room functions. It provides support to the Commander in discipline, morale, and administration of squadron personnel. Other special staff functions include Resource Management, Training, and the Unit Mobility Center.

Automation Efforts. Compared to BCE squadrons, which implemented BEAMS in the early 1970's, RED HORSE squadrons have only recently shifted their interest toward automation. Early efforts were mainly focused on administrative functions through the acquisition of word processing equipment. In 1984, the 820th and 823rd RED HORSE squadrons received Z-100 micro-computers as part of a Headquarters Tactical Air Command (HQ TAC) computer buy. While some of the micro-computers were to be used for mobility applications, such as load planning, the squadrons were left to develop their own applications for the remainder of the systems. A 15 May 1985 RED HORSE

Information Management System (RHIMS) study, conducted by the Air Force Civil Engineering and Services Center (HQ AFESC), stated the automation requirement for RED HORSE squadrons:

> A computer system with interface and broadband network inclusive of all RED HORSE squadrons, deployed locations and sites. Implementation of this integrated information management system for resource allocations, scheduling, tracking and control using CRT terminals; programmable intelligent terminals; sheet, continuous form, and portable printers; plotters; and minicomputers. The system will provide a central point for information regarding training; personnel actions; work force management and assignments; mobility and deployment planning; administrative management of squadron activities; work processing and control to include tracking, material processing, job management to work processing, tracking, and long requirements generation, and design scheduling and analysis; and squadron financial management. This system will provide almost total automation of the critical functions of a civil engineering RED HORSE squadron and provide management with summary data on the operation of the organization to allow identification in graphical format of problem areas and inefficient operations. (6:1)

During October and November 1986, the 820th and 823rd RED HORSE squadrons each received a WANG VS-100 mini-computer system which consisted of 30 workstations, one central processing unit, two 175-megabyte disk drives, one 75-megabyte disk drive, and three printers. These systems were transferred from Air Force Regional Civil Engineer (AFRCE) offices by the Directorate of Information Systems, HQ AFESC/SI, as a result of AFRCE hardware upgrades. These systems were valued at over $200,000 each (26).

Initial telephone interviews with several key managers at the 823rd RED HORSE indicated little support for the new computer system. Some concerns voiced were as follow: "It will costs us $30,000 a year to maintain!", "Is the 823rd ready for this much computer?" "We can do everything our section needs on a Z-248." "Can we justify this system?" Questions concerning the plan for installing the system elicited such responses as: "Maybe we should be asking--Do we want to take it out of the box?" "It may not be to late to nip this [WANG computer] in the bud."

These concerns may reflect limited knowledge and experience of squadron personnel with automated management systems and their own information needs. Since the system is basically a "forced implementation" initiated by the Major Command (MAJCOM), Tactical Air Command (TAC), and HQ AFESC, squadron personnel may have trouble supporting the implementation. In addition very little direction was provided to the squadrons to implement the system (5; 36).

During a RED HORSE Commanders Conference in April 1987, the HQ AFESC Directorate of Readiness and the RED HORSE Squadrons decided to postpone the implementation of the WANG systems and proceed with the development of application software for the Z-100 and Z-248 micro-computers (7; 12; 35). The 203rd CES(HR) Air National Guard, a newly formed unit, was designated as the pilot unit for RED HORSE automation. This unit was selected because they volunteered and because they had a few people in their unit who were interested in personal computers (12; 35).

Problem Statement

The direction RED HORSE automation efforts took as the result of the 1987 RED HORSE Commanders Conference appears to represent a wholesale abandonment of the concepts established in the 1985 RHIMS study. If the RED HORSE automation program is designed by individuals oriented towards personal (micro) computers, the resulting system will most likely take that form. Also, if the system is designed by a few individuals with limited knowledge of the information requirements of the users outside their own section, the resulting system may not be well integrated for total squadron support. This approach raises several questions. Will the designers understand the information needs of all squadron managers? Will their system design satisfy the automation requirements of other squadrons? Finally, will their design allow for system growth as other applications arise?

The 1975 RHIMS study noted several problems with the existing systems based on micro-computers and host base automation support. According to the study,

> Only limited procedures are available to produce special inquiries or reports or to establish application data bases. These procedures are often inadequate due to data field constraints, lack of automated editing, and the need to use a nonuser oriented programming language to develop application reports. Additionally terminals are limited in number and physical availability discourages user involvement in the existing system. . . . Our present method of using other organizations' automated systems allows RED HORSE to automate only a small part of work requirements and is not state-of-the-art nor user

> friendly if it is available at all. . . . The current system being used by RED HORSE is not responsive enough to functional user requirements for information, nor is it flexible enough to allow user development and fine tuning of information subsystems. (6:2)

It is not clear if an automated system based on stand-alone micro-computers will overcome these problems; however, the design of a mini-computer based network system would also pose problems.

If RED HORSE squadrons implement an automated management system based on the WANG computer, they will be given the BCE WIMS software to select the application programs they can use or modify. It will be the responsibility of each RED HORSE squadron to develop the balance of the applications to meet their unique requirements (14; 48). This would be a difficult task for several reasons. First, RED HORSE squadrons lack expertise in working with computers, since their only prior experience is with small Zenith Z-100 and Z-248 micro-computers. Secondly, the small number of RED HORSE squadrons will not get the cross-flow of ideas and applications that BCE organizations will. This is due to the fact that there are only four active RED HORSE squadrons, whereas there are over 100 BCE squadrons that will be using WIMS. Finally, the difference in the RED HORSE mission makes it difficult for them to develop specific applications.

A BCE squadron has fairly standard base operating and maintenance responsibilities that require specific computer applications such as real property, utilities management, military family housing, and contract management. RED HORSE squadrons do not have base maintenance responsibilities, and are much more mobile. They spend most of their time training for their wartime mission, either in garrison or at deployed locations. Thus, they may not be able to dedicate personnel to the development of applications. Their people may simply not have the time, due to deployments and exercises.

The primary problem seems to be the lack of any central policy, based on a detailed analysis of user needs, to guide the development of automated management systems for RED HORSE squadrons. There is no analysis to validate the early automation program decisions. For managers in the RED HORSE squadrons, the management questions are--What type of system do we need, and how do I get the greatest benefits from it? This research attempted to answer these questions and provide a basis for future policy decisions by identifying user requirements through data collection and analysis.

Research Objectives

The objectives of this research were to [1] identify areas where MIS/DSS systems should be applied, [2] provide recommendations for the development of specific DSS applications, and [3] provide recommendations for the implementation and long term development of these systems.

Research Questions

To make the most effective use of these automated management systems, managers must develop good applications and implement them effectively. Specifically, the following questions must be answered:

1. Who are the key managers and what are their decision-making information needs?

2. What are the problems associated with current information processes?

3. What capabilities of the MIS/DSS system are required?

4. What factors will affect the implementation of the system?

Assumptions

This research was based on the following assumptions:

1. No major changes to the RED HORSE mission or management policy will occur in the near future.

2. Basic operating procedures, mission, and policy are the same for all RED HORSE squadrons, since AFR 93-9, Civil Engineering RED HORSE Squadrons, governs.

Scope and Limitations

The basic purpose of this research was to identify some specific computer applications and make recommendations as to their design and implementation. This information provides a starting point for the development of prototype MIS/DSS systems that will demonstrate the usefulness of the system and help stimulate user interest in developing other applications. Furthermore, it was not the objective of this research to write the actual software for the MIS/DSS applications, but to identify specific applications and the associated system capabilities to support them.

Due to time constraints and the difficulty associated with getting information from overseas bases, only two CONUS RED HORSE squadrons, the 820th CES(HR) and 823rd CES(HR), were considered in this research. The focus of the applications was limited to the peacetime management activities of a RED HORSE squadron, and did not address the automation needs of a squadron deployed under field conditions. Despite this scope limitation, the methodologies presented in this research can be used to determine those needs.

II. Literature Review of MIS/DSS Design and Implementation Methodologies

Since the development of the first computer, automated information systems have been evolving from large expensive systems with limited utility, to smaller inexpensive systems with powerful applications for practicing managers. The earliest Data Processing (DP) systems evolved into Management Information systems (MIS), which focused on improving the efficiency of managers (2; 42). In more recent times, information systems have evolved that focus on the improved effectiveness of decision makers. These systems are called Decision Support Systems (DSS). The concept of Decision Support Systems is relatively new. Indeed, most of the theory associated with DSS has occurred since the early 1970's and too little research is available to offer a universally accepted prescription for designing and implementing these systems.

In this chapter, the current literature will be reviewed in order to develop a methodology for accomplishing the research objectives. First, some differences between MIS and DSS and their development processes will be examined. Next, different analysis methodologies will be discussed to provide a basis for data collection and analysis. Finally, various considerations for system implementation will be reviewed to guide the recommendations for the long term development of RED HORSE automation systems.

MIS versus DSS

According to Menkus, Management Information Systems "are those [systems] that drive the organization; they carry out its basic functions--funds accounting, production control, and the like" (30:32). The primary focus of MIS is on information flows, structured tasks and decisions, improving manager's efficiency, and data inquiry and report generation (28:1,2; 42:7). DSS, on the other hand, are "interactive computer-based systems that help decision makers utilize data and models to solve unstructured problems" (42:4). A DSS combines a dialog component, which provides the user-interface; a memory component, which includes a data base; and a modeling component that provides the analytical capabilities for problem solving (42:260,301).

The primary focus of DSS is on decisions, semi-structured and unstructured tasks, improving the effectiveness of managers, and user-initiated and user-controlled models that help conceptualize the problem or decision (28:2; 42:7). DSS may use information provided in an MIS (30:32), and are generally regarded as representing "a natural evolution in computer applications" (28:2).

MIS System Development Process

According to Alexander (1:126-128), the systems development process can be divided into three phases: the systems analysis phase, the design phase, and the implementation phase. In the systems analysis phase, a detailed description of the system is developed to allow the analyst to "examine its individual segments and understand thoroughly the reasons behind any peculiarities he may find" (1:127). This descriptive model is developed using many information sources such as policy and procedures manuals, organization charts, and personal interviews with managers and subordinates in the organizational units.

In the design phase, the descriptive model is used to identify deficiencies in the existing system. A normative model is then developed to overcome these deficiencies.

The final phase is the implementation of the new system. In this phase, the specifications for the new system are developed and put into action by an implementation plan which sets forth the activities and individuals responsible for accomplishing them. This includes the development and testing of computer programs, training for the people who will use the system, and periodic evaluations to control the overall implementation program.

DSS System Development Process

The development approach for DSS systems is similar to that for MIS systems in that it requires a description of the current system as a starting point for the development of the new system.

Sprague and Carlson (42) recommend a four-phased development process that assesses user needs and builds user commitment early in the development of the system, and provides for an evolutionary development process based on the implementation of a specific DSS.

Phase I: Preliminary Study and Feasibility Assessment. Surveys and interviews with key managers are used "to determine the extent of DSS-type applications" and "the likelihood that these needs will continue or increase in the future" (42:67). The implementer starts explaining the DSS to users during this phase.

Phase II: Developing the DSS Environment. Once it has been determined that a DSS is needed, a DSS group is formed to formulate the objectives, manage the development effort, and help users "bring the technology to bear on his or her problems" (42:64). During this phase, the "minimal set of tools [hardware and software] and data" are acquired to start the first DSS, and the group continues to build user commitment to the project.

Phase III: Developing the Initial Specific DSS. During this phase, the DSS group works with users to identify a need "with a high probability of early observable benefits" (42:68), and to develop a specific DSS to deal with this need. The specific DSS supports a specific decision or a specific decision-making process (42:301). This initial specific DSS is upgraded and refined to respond to users' needs.

Phase IV: Developing a Subsequent Specific DSS. This final phase is really a continuous process of finding new applications and developing specific DSS to deal with them. The authors note that this "staged development approach leads to the development of a DSS generator which evolves from the process of building several specific DSS" (42:69).

Keen (28) recommends a pre-design cycle to help identify the decisions that may benefit from decision support and to introduce, early in the design process, those factors such as user commitment and resources that will affect implementation. This pre-design cycle, as outlined in Figure 2, helps to select areas for DSS support and to define, compare, and select specific design alternatives.

Perhaps the most significant difference in the design of MIS and DSS systems is the focus of the design effort. Whereas MIS design is a process oriented approach that focuses on the inputs and outputs of the system, the design of a DSS must be process independent and focus on what the system is intended to do (28:180).

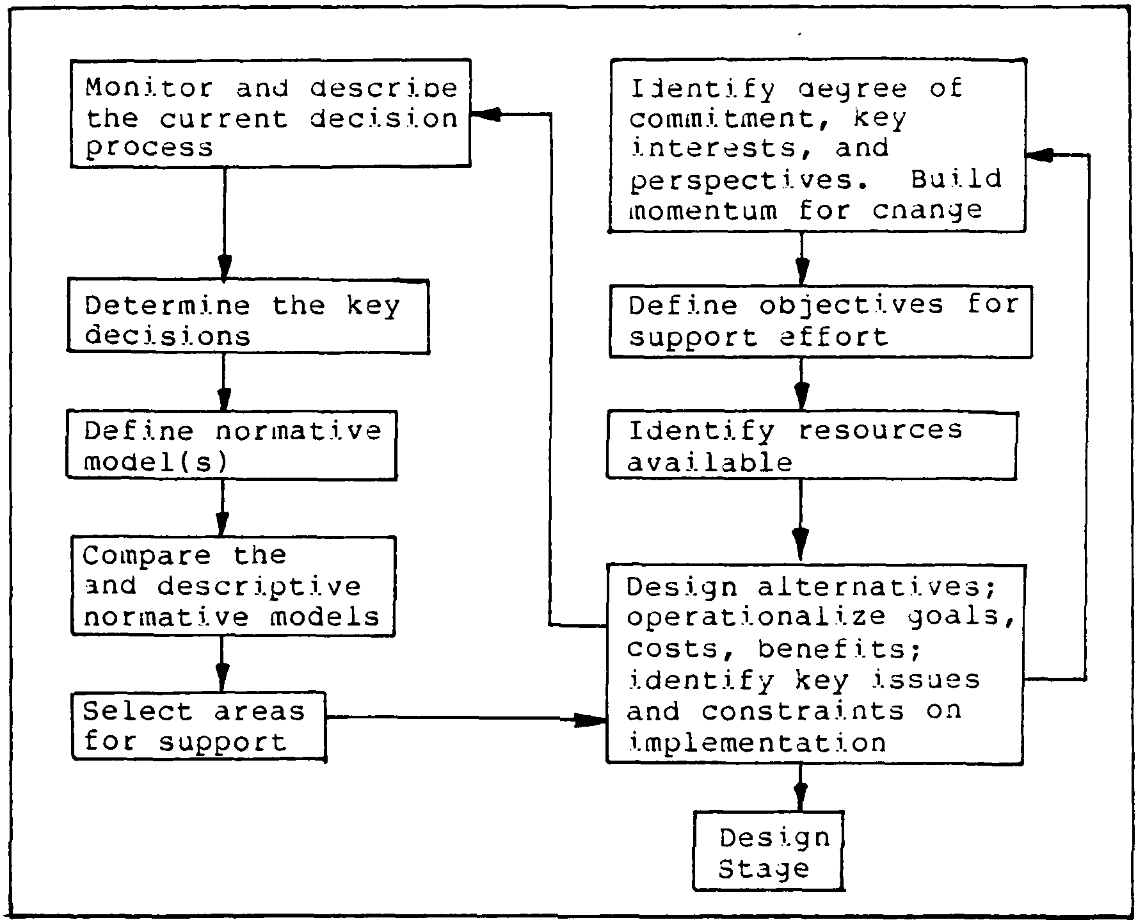

Figure 2. The Pre-design Cycle (28:177)

Decision Type and Structure

The design of a DSS must be process independent. It must be built in the context of the decision and the decision maker. Keen (28:85-96), describes a framework for analysis of decisions that allows the system designer to identify those decisions that are better suited for either MIS or DSS support. This framework is based on two unidimensional taxonomies developed by R.N. Anthony and H.A. Simon (28:81).

The first dimension classifies the decision in three categories with respect to the type of decisions involved. The first, strategic planning, is "the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to obtain these objectives, and on the politics that are to govern acquisition, use, and disposition of resources" (28:82). The second, management control, is "the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (28:82). Finally, operational control is "the process of assuring that specific tasks are effectively and efficiently carried out" (28:82).

The second dimension classifies decisions by the level of difficulty or to the extent that they are repetitive and routine. Structured decisions are those decisions that do not require a manager to solve. They are routine to the point that a procedure has been developed to handle them. Clerical personnel, data processing, or management science models are best used here. Unstructured decisions are those hard or unusual decisions that cannot be programmed and require some degree of human intuition to solve. Semi-structured decisions are those decisions that are difficult enough to require some system support, but also require some judgment and intuition on the part of the manager. DSS are best used here.

TYPE OF DECISION	MANAGEMENT ACTIVITY			
	Operational Control	Management Control	Strategic Planning	Support Needed
Structured				Clerical, EDP or MS Models
Semi-Structured				DSS
Un-Structured				Human Intuition

Figure 3. A Framework for Information Systems (28:87)

MIS/DSS Analysis Techniques

As mentioned previously, the starting point for the development of a DSS is a descriptive model of the existing system. Systems analysis techniques are used to develop the descriptive model.

Systems Analysis. Systems analysis attempts to determine the essential nature of present information flows. "Documenting them establishes a conceptual base both for the detailed analysis of the current system and the subsequent development of the improved one" (1:131). According to Sprague and Carlson, "Systems analysis refers to the initial steps, which include 1) analyzing the existing activities or problem area, and 2) defining the performance requirements of the system that will be applied to those activities" (42:94).

According to Munro, "determining the information each manager needs" is "generally recognized to be one of the most difficult phases in the development of Management Information Systems (MIS)" (33:34). He describes two systems analysis techniques for analyzing managers information needs. These two approaches, data analysis and decision analysis, differ as to their focus. As their names suggest, data analysis focuses on "an analysis and improvement of the existing flow of data to the manager" (33:35), whereas "decision analysis primarily involves an analysis

DATA ANALYSIS	DECISION ANALYSIS
1. Examine all reports, files and other information sources drawn upon by the manager.	1. Determine major decision responsibilities through discussion with the manager.
2. Discuss with the manager the use of each piece of information examined.	2. Determine policy and organizational objectives relevant to decision areas identified.
3. Eliminate unnecessary information.	3. Determine specific steps required to complete each major decision.
4. Determine unsatisfied information needs through interaction with the manager.	4. Develop a model (flowchart) of each decision.
	5. Examine flowchart to determine information required at each step in the decision.

Figure 4. Data and Decision Analysis Procedures (33:35,36)

of decisions made by the manager, the objective being to determine the information required at each step in the decision process" (33:35). The elements of these two methods are shown in Figure 4.

Data analysis involves an extensive examination of the information a manager uses, as well as interviews with the manager, to determine the manner in which the information is used. The data analysis method,

> ... involves analyzing a manager's existing information flow to determine information no longer required, information to be continued, and new information requirements. Information no longer required is eliminated; required information is provided by the information system applications where appropriate. (33:35)

Decision analysis is based primarily on interviews with the manager to determine his decision responsibilities. The decision analysis method

> ... involves first determining the major decision responsibilities of the manager, and the appropriate organizational policy and objectives. Next, the manager articulates the various decision steps and the information used at each step. The analyst develops a decision flowchart representing the decision steps and the information used at each step. The manager and the analyst then refine both the decision process and the information requirements. The revised decision flowchart constitutes the final statement of information requirements for each decision. (33:36)

According to the author, the method used will depend on the situation. Generally, data analysis is best used "where the decision-making is well-understood, routine and repetitive" and decision analysis is best used "where the decision-making is poorly understood, less routine and less repetitive" (33:39). More often than not, the analysis used will be a combination of the two.

Standard systems analysis techniques such flowcharting are useful for developing the descriptive model. However, these techniques are inadequate for defining the performance requirements of a DSS.

ROMC Approach. Most decision makers rely on conceptualizations of the problem or decision and have trouble describing the actual decision making process (42:98). Because the DSS support requirements cannot be adequately defined in advance, another systems analysis technique was developed that focuses on the things a user needs in order to make a decision.

> The approach is based on a set of four user-oriented entities: Representations, Operations, Memory Aids, and Control Mechanisms. The capabilities of a DSS from the user's point of view derive from its ability to provide representations to help conceptualize and communicate the problem or decision situation, operations to analyze and manipulate those representations, memory aids to assist the user in linking the representations and operations, and control mechanisms to handle and use the entire system. For obvious reasons we call it the ROMC approach. (42:96)

This process independent method defines the components of the specific DSS in terms of "the set of ROMC required by the user to face the decision-making and problem solving tasks" (42:116). To use this analysis, the decision is first examined in terms of the intelligence, design, and choice operations used in decision making. This model, developed by H.A. Simon, describes these operations:

> Intelligence: Searching the environment for conditions calling for decisions. Raw data are obtained, processed, and examined for clues that may identify problems.
>
> Design: Inventing, developing, and analyzing possible courses of action. This involves processes to understand the problem, to generate solutions, and to test solutions for feasibility.
>
> Choice: Selecting a particular course of action from those available. A choice is made and implemented. (42:26-27)

Once the decision is divided into these three phases, the representations, operations, memory aids, and control mechanisms required to support these activities are determined.

The representations "provide a context in which the user can interpret outputs and invoke the operations" (42:102). These representations are what the user sees: the interface between the system and the decision maker. They may take on many forms such as lists, graphs, reports, and data entry forms (42:102-103).

The operations provided by the system perform the data manipulations to create information. Operations "may involve complicated decision aids, such as simulation models or forecasting algorithms" or simply selecting subsets of data or generating statistics (42:104).

Memory aids "support the representations and operations" by providing data bases, workspace,and libraries for "accumulating results or the operations on the representations" (42:104-105).

Finally, the control mechanisms provided by the system "facilitate the mechanics of using the system. Examples are menus or function keys for operation selections" (42:106) and other features which help the decision maker use the system. The specific set of Representations, Operations, Memory Aids, and Control Mechanisms make up the specific DSS (42:116).

DSS Development Tactics

The design of Decision Support Systems is an evolutionary process. The system is constantly modified and improved as the user's decision support requirements change. The development of a DSS represents a considerable investment of both time and resources. Organizations must decide on the level of detailed planning and integration they will put into the development of the DSS. The more planning detail, the more it will cost and the longer it will take to develop. On the other hand, without adequate planning and integration, the useful applications of the system may be limited. The system may be too inflexible to accommodate other applications as they arise. Sprague and Carlson describe three general approaches to the development of DSS:

1. The Quick-Hit. This approach requires the least development time and effort, and is best used when "there is an immediate problem area but no evidence of long term need" (42:60-61). The organization purchases or develops a

specific system to "capture the benefits, then considers what to do next" (42:60). The resulting system is a specific DSS, or "the hardware/software that allow a specific decision maker or group of them to deal with specific sets of real problems" (42:10). This approach is the fastest way to develop a specific DSS, but is least flexible in adapting to other applications that may develop.

2. The Staged Development Approach. Some amount of advanced planning is invested in the development of a specific DSS. An iterative design process is used to incorporate new applications while "giving a somewhat early payoff through the completion of one specific DSS" (42:61). This approach requires more time and investment than the "quick-hit" approach, but is more flexible and leads to the accumulation of a general DSS Generator capability. A DSS Generator "is a package of related hardware and software which provides a set of capabilities to build specific DSS quickly and easily" (42:11).

3. The Complete DSS. This approach requires extensive development time and investment, since a completely integrated DSS Generator is developed before any specific DSS is built (42:61). This approach may take years to develop, but the resulting system will be better integrated to support many applications. It is, however, very susceptible to technological obsolescence due to its long development time.

Implementation

Equally important to the design of a MIS or DSS is its implementation. Even the best systems are useless if they are not used by the people they are designed to support. Multinovich and Vlahovich define implementation as a process that "entails bringing a system or subsystem into operational use and turning it over to the users" (32:8). They feel implementation should be a part of the "total system design effort, which begins with systems analysis and concludes with testing phases" (32:8).

Keen and Morton note that successful implementation strategies may be applied to both MIS and DSS, but the implementation of a successful DSS may require more effort. They state that,

> ... for a system that automates a well-defined procedure with few organizational interdependencies, design is the key issue; for a DSS, which explicitly focuses on management processes and which aims at changing procedures and concepts, implementation may be far more complex than the formal design process. (28:189)

Factors Affecting Successful Implementation.

According to Keen and Morton, past researchers have had great difficulty interpreting patterns of success or failure in system implementation case studies. However, they concluded that the presence of the following factors increased the likelihood of success:

1. Top management support.
2. A clear felt need by the client.

3. An immediate, visible problem to work on.

4. Early commitment by the user and conscious staff involvement.

5. A well-institutionalized OR/MIS or MIS group. (28:196)

Alter's research on system implementation led him to conclude that "the likelihood of successful implementation increases to the extent to which the user has initiated the system and participated in its development" (2:154).

Strategies for Successful MIS/DSS Implementation. Alter recommends an implementation strategy based on a risk assessment of the current implementation environment. This method consists of identifying the differences between the existing situation and "an ideal implementation situation. Deviations between the existing circumstances and the ideal are identified as risk factors" and an implementation strategy or "course of corrective action" is developed to handle each deviation (2:155,158).

Alter describes this ideal implementation situation as one which allows the implementation process to "be planned and controlled with maximum certainty" (2:157). Under this ideal situation,

> the system is to be produced by a single implementer for a single user who anticipates using the system for a very definite purpose that can be specified in advance with great precision. Including the person who will maintain it, all parties affected by the system understand and accept in advance its impact on them. All parties have prior experience with this type of system, the system receives adequate support, and its technical design is feasible and cost-effective. (2:157)

Multinovich and Vlahovich recommend some people and system related strategies to be considered during the implementation process (See Figure 5).

Getting management involved with the implementation process is important because management must approve the resource expenditures required to develop and implement the system. They motivate subordinates to provide support to

People Related Strategies

Get Management Involved

Ascertain That There is a Felt Need for the System

Get User Involvement

Provide Training and Education

Consider User Requirements

Consider User Attitudes

Establish Effective Communication

Keep Interface Simple

Let Management Determine Information Usefulness

System Related Strategies

Identify the Problem

Plan the Implementation

Control the Implementation Process

Do Post Implementation Evaluation

Figure 5. People Related and System Related Implementation Strategies (32:9)

the implementation process, and they can affect interdepartmental coordination and cooperation (32:9). People will not use the system unless they feel it meets their needs and is useful to them. The authors recommend implementers work with users to "sell them the system" by helping them identify problems suited for system support, getting users involved in the system design and by explaining the benefits of the system in terms of what it can do for them (32:11).

Training programs should include "educating the user in the overall purpose of the system: what it is supposed to do, how does it do it, why do we want or need it done, and who must do it" (32:10).

Implementers must consider user requirements such as "flexibility, simplicity, reliability, economy, accuracy, compatibility, security, etc." (32:11), in order to provide a system that meets the users' needs. The authors state that, "a new system should satisfy a particular user's requirements without adversely affecting the information requirements of other users in the system" (32:11). This might be provided through the use of reports, tailored to the specific individual, that draw data from a master database. The implementer must also consider the future plans of the organization and the possibility for future expansion of automated applications to avoid having the organization outgrow the system and face the cost of implementing a new or larger computer system (32:11).

Failure to consider user attitudes towards the system can greatly reduce the success of the implementation and the effectiveness of the system. Once user attitudes are recognized, the strategies for getting user involvement and providing training can be used to influence those attitudes.

Establishing effective communication between the implementers, management, and the system users is essential during the implementation process. The communication process should be analyzed, and "if necessary, the organizational design adjusted to increase" user involvement (32:12). Keeping the interface simple is another strategy that will increase the acceptance of the system. To the user, the interface is the system. It "must be kept simple so as not to scare or confuse the user" (32:13). Also, the information produced by the system must be useful and important to the user or the system will not be accepted. The usefulness of this information must be determined by the user--not the designer or implementer (32:13).

The system related strategies shown in Figure 5 can be summarized as (1) determining the right applications for the system to support, (2) planning the implementation early on to ensure compatibility with the systems design, (3) controlling the implementation by setting goals and measuring performance through systematic reviews, and

(4) evaluating the implementation based on "a prior definition of improvement" to determine if "system modifications should be made" and "when the system is complete" (32:15).

Summary

In this chapter, differences between MIS and DSS were examined, and various systems analysis methodologies were presented for designing effective MIS and DSS applications. This literature indicates that an analysis of the users' decisions and information needs provides a starting point for the design of both types of systems. Systems analysis techniques that focus on information inputs and outputs are better suited for the MIS design process. Systems analysis techniques that are process independent, such as the ROMC approach, focus on the decision maker and his decision-making requirements and are better suited for DSS design.

Finally, the implementation strategies provided in the current literature offer the implementer some techniques to increase the effectiveness and acceptance of the resulting systems. The techniques discussed in this chapter will now be used to develop methodologies for accomplishing the objectives of this research effort.

III. Methodology

This chapter will present the methodology that was employed to accomplish the research objectives. The four research objectives will be reviewed and the methodology used to accomplish each objective will be discussed.

Identification of DSS Application Areas

According to Keen, "the first step in design is to select the right problem to work on" (28:167). The identification of potential MIS/DSS application areas followed these steps:

Identify Key Decision Makers. A review of policy guidance (such as AFR 93-9 and TAC Regulation 85-3, Management of Training Projects, Civil Engineering RED HORSE Squadron), organization charts, handbooks, and telephone and personal interviews with squadron personnel were used to identify the key decision makers and their critical decisions and information needs. The data and decision analysis techniques described by Munro (33) were used to summarize the specific information requirements into a table which indicated the organizational sections that supplied the information and those that used the information. Typical decisions made by managers in each section were arranged in a decision matrix based on the framework developed by Anthony and Simon (28:81-96). This decision matrix classified the various decisions according to their degree of structure (unstructured, semi-structured, and structured) and the level of management (strategic planning, management control, and operational control) at which they were made. The results of each analysis were forwarded to each RED HORSE squadron for validation.

Determining Problems with Current Processes. Interviews with squadron personnel were used to determine problems with the current information and decision processes. These problems are summarized by each section in Chapter 5. These problems and the data and decision analysis results were used to determine which applications were better suited for MIS and which were best suited for DSS.

Recommendations for Development of Specific DSS

The decision matrix, described above, and interviews with key managers provided several critical decisions which were used to determine the required system capabilities.

Descriptive Models. Information obtained from regulations and interviews was used to develop a descriptive model of these critical information and decision process. This step paralleled the first step in the predesign cycle--"Monitor and describe the current decision process"--as described by Keen (28:174). Information and decision processes flow across organizational boundaries (Figure 6) in a complex system of information interdependencies. Figure 6 represents this system as a

Venn diagram. In this organizational system, information generated by one section may be used by another. Also, decisions made by one manager may affect managers in other sections. The descriptive models will be used to explore these relationships.

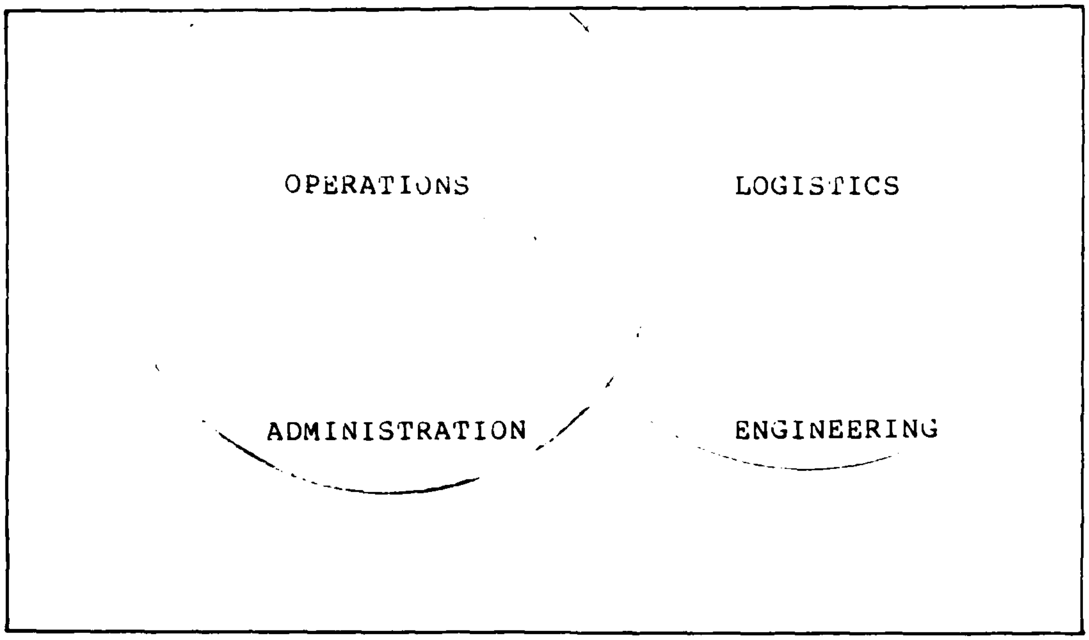

Figure 6. Venn Diagram of Organizational Boundaries

<u>Develop Normative Models.</u> In this stage, more detailed interviews with key managers provided information that described how the information and decision processes should work. Problem areas were identified by comparing the descriptive and normative models. Potential DSS application areas were selected from problem areas associated with semi-structured and unstructured decisions.

Required DSS Capabilities. To answer this research question, key decisions in each application area were analyzed in terms of the intelligence, design, and choice activities performed by the decision maker. The ROMC approach was used to define the DSS capabilities required to support these decision activities. This was accomplished by identifying the required Representations, Operations, Memory aids, and Control mechanisms corresponding to each of the intelligence, design, and choice activities, as recommended by Sprague and Carlson (42).

Recommendations for System Implementation

Recommendations for implementing the above DSS applications were obtained from answers to the last research question: What factors will affect the implementation of the system?

A simplified risk assessment was performed to identify potential problems in the implementation process. Strategies for overcoming these problems were developed based on strategies documented in the current literature, modified to fit the RED HORSE squadron environment.

IV. Findings

This chapter presents the findings that resulted from the research methodology outlined in Chapter 3. Key managers in the RED HORSE squadron were identified from AFR 93-9, Civil Engineering RED HORSE Squadrons (17) and interviews with RED HORSE Commanders and branch chiefs. These interviews were conducted using the interview questions listed in Appendix A. Critical activities, typical decisions, and information needs were determined from personal and telephone interviews, and from a review of policy guidance, operating handbooks, and other materials. These findings will be presented for the command section, special staff, and each branch.

Command Section

According to AFR 93-9, the major responsibilities of the command section are to "exercise command jurisdiction and control over the mission accomplishment of the squadron during training, exercises, deployments, and other mission activities"; to ensure compliance with higher headquarters directives; and to direct and control "activities related to the logistics, engineering, operations, and administrative branches, the special staff, and any PDUs (Permanently Detached Units)" (17:16).

<u>Commander.</u> Interviews with commanders indicated their primary decisions to be those dealing with allocating squadron resources to competing project priorities and assessing organizational performance (12; 29).

It was noted that the current information management system does not provide a consistent way to display squadron performance in various areas such as project design and construction updates or the status of personnel, equipment, and financial resources (12). Although commanders were not interested in the detailed information of activities within each section, they felt they needed the status of project scheduling and design, materials, funding, and equipment to ensure both the host bases and the squadron were ready to support the project deployment, allowing projects to proceed on schedule and squadron personnel to be employed productively. During deployments, commanders need actual versus scheduled progress information to make decisions involving the scheduling of training exercises and other projects. Some typical decisions for commanders are presented in Appendix C, Key Decision Matrix. The commanders' specific information needs are presented in Appendix B, Data Analysis of Information Needs.

<u>Deputy Commander.</u> The Deputy Commander assists the Commander with many daily management control activities. Information needs for these managers are similar to those of the Commander and include more detailed information on

project status and scheduling to determine when to halt projects and return personnel for squadron home station training in a manner to cause least impact to the project schedule and host base (41). Squadron training information is also required to ensure personnel are trained and combat readiness is not degraded. Since project deployments often cause conflicts with training appointments, squadrons need a way of integrating project schedules with training schedules. Typical decisions for deputy commanders are presented in Appendix C. Their specific information needs are presented in Appendix B.

According to LtCol William Schaal, 823rd CES(HR) Deputy Commander, the current information system presents several problems. Accurate and current cost of projects accomplished by the squadron are difficult to determine due to the manual procedures for accounting for material expenditures, credits, TDY, and labor costs. Also, similar information provided by different sections does not agree. For example, vehicle status information provided by the Operations Center does not agree with that provided by the Vehicle Maintenance section. Finally, frequent changes in the project design and construction schedule make it hard to get accurate and current information on the status of programs and resources (41).

Operations Branch

This branch is primarily concerned with the execution of the Troop Training Program; maintaining special construction capabilities such as explosives demolition, well drilling, and asphalt paving; and the training and assignment of branch personnel on the squadron's mobility teams. Key managers in this branch are the Director of Operations (DO), Chief of Cantonment Flight (DOS), Chief of Airfields Flight (DOP), and the Chief of the Operations Center (DOO).

Interviews with various individuals in this branch indicated some specific decisions and questions facing these managers. These are presented in Appendix C. Typical decisions made by the managers in this branch can be classified as

(1) Project Scheduling - Which projects can we do? When and in what order? These are decisions made jointly by DO, DOO, DOS, and DOP (13; 39; 40).

(2) Personnel Scheduling - Who will we send? For how long? Should we return this individual to the squadron or re-deploy him to another project location? These decisions are made primarily by DOS, DOP, and DOO (13; 39; 40).

(3) Equipment Scheduling - How will we allocate equipment resources to competing projects? These decisions are made primarily by DOP and DOS (3; 13; 40).

Director of Operations. The primary information needs of the Director of Operations were determined to be project scheduling and tracking, personnel and training status, equipment availability, and branch financial management information. Key decisions involved scheduling a level of project effort that provided adequate proficiency training to branch personnel without over-tasking individual shops (39; 40). It was noted that the current manual information system did not provide adequate information to allow this manager to assess the impact of the project schedule on his people, their training, or the squadron's readiness posture (40).

Chief, Cantonment Flight. The Chief of Cantonments Flight is responsible for managing, controlling, and directing 130 men in various shops. His primary information needs include personnel availability, project requirements, project status, and training status. His key decisions involve the selection of individuals for project deployment and maintaining the required training and mobility capability for personnel assigned to his section.

The existing squadron information management system makes it difficult to determine the individuals required for each deployment and their availability. Project evaluations from DE showing the manpower and equipment requirements are often received within 30 days of the scheduled start date (45). By the time supervisors can determine who is available and formulate crew lists, individuals deploying receive only a few days of notice for their pending deployment. The lack of advance notice for long deployments (e.g. three months) causes personal problems and adversely affects unit morale.

Finally, personnel deploying on a project must outprocess through several sections. The Training Section determines whether the individual needs training; Logistic Plans ensures he has updated shot records and dog tags; and Unit Administration determines whether he has pending disciplinary action, personnel actions, performance reports or awards he must complete. If conflicts arise, the individual may not be deployed, and the crew list may be reaccomplished.

Chief, Airfields Flight. The decisions and information needs of the Chief of Airfields Flight are similar to that of the Chief of Cantonment Flight. This manager also controls the squadron vehicle dispatch and operator care function, and requires detailed vehicle and equipment status information for selecting equipment for project deployments. It was noted that the high level of TDY for individuals assigned to both the Cantonment and Airfields Flights caused problems in meeting Airman Performance Reports (APR) and award suspenses (3; 13). Also, the current squadron information system did not provide adequate personnel information, such as leave projections and training status, to assist managers in matching personnel available with project requirements (13).

Chief, Operations Center. The Operations Center chief interfaces with DE for project design status and to determine manpower and equipment requirements based on the project evaluation accomplished by DE's project engineers. He also needs vehicle and equipment status which he gets from LGT and DOP, personnel availability information from DOS and DOP, and status of materials for local projects and work orders from LGS. He maintains shop labor accounting information, and provides project cost information to FM. Interviews with Operations Center managers indicated several problems with the existing squadron information system.

The current manual system of tracking project cost and maintaining man-hour labor accounting is very time consuming, and accounts for a large portion of the Operations Center's daily workload (45; 47). This section currently uses micro-computer based spreadsheets to maintain the In-house Work Plan (IWP), but labor accounting and work scheduling is still manually accomplished. Also, the Operations Center provides reports indicating personnel TDY. This information is also collected and maintained by LGX and DA, but is in different formats and does not always agree (9; 45). Finally, changing project priorities and project delays due to weather or problems with host base support cause frequent changes in the squadron's project schedule. The existing information management system is too slow in providing accurate information needed to evaluate these changes in terms of the manpower, equipment, and resources required.

Logistics Branch

A review of regulations and interviews with squadron personnel indicate the key managers in this branch are the Director of Logistics (LG), the Chief of Logistic Plans (LGX), the Chief of Supply (LGS), and the Chief of Vehicle Maintenance (LGT). These managers' decisions and decision-making information needs are presented in detail in Appendices C and B respectively, and are summarized below:

(1) Logistics Management - What equipment do we need? Are we efficiently managing our material resources? Do we have adequate material and equipment stocks? These decisions are made by all sections in this branch.

(2) Readiness Management - Can this squadron support the tasking indicated in this mobility plan? What is our current readiness rating? Is this individual available for deployment? These decisions are made primarily by LGX and LG.

Interviews with branch personnel indicated some typical decision-making information needs and problems with the current information systems.

Director of Logistics. The LG's primary information needs are vehicle and equipment status from LGT, equipment requirements from DOO, funding and supply status information from FM and LGS, and mobility status information from LGX. This information is used to make decisions involving the day-to-day management of the branch.

Chief of Logistic Plans. Critical decisions involved the determination of the squadron's mobility readiness, and the configuration of personnel and equipment increments for deployment. Information needs were training status from OT; personnel status from DA and DOO; mobility team assignments from all squadron sections; and equipment and cargo data from all sections such as weight, cube, load lists, and transport restrictions (16; 36).

It was noted that the current micro-computer based load planning system used by LGX does not provide a reliable product that indicates how the mobility increments should be configured for various aircraft types. They feel a need for a computer assisted load planning system that allows them "to shift increments around and generate a modified load plan" (9). Also, information used by LGX is quite fragmented. They receive training information (such as individual skill and special capability training), from OT, but schedule and maintain mobility training such as pallet build-up, cargo courier, and hazardous cargo training themselves (16; 36).

Chief of Supply. The Chief of Supply's primary decisions involve the management of squadron materials to support the operation of the squadron, the accomplishment of projects and cantonment maintenance work, and mobility training and deployment exercises; and the management of funds used to acquire these materials.

Interviews with these managers indicate a major problem in the lack of integration between the squadron and the host BCE and base supply automated information systems that support the RED HORSE squadron. According to CMSgt Robert Dycus, Chief of Supply for the 820th RED HORSE, the lack of such an interface with the BCE Government Owned Civil Engineering Supply Store (GOCESS) means that RED HORSE material requisitions must be delivered to the host BCE for input into their Civil Engineering Material Acquisition System (CEMAS). One individual from the 820th's Supply Section works in the BCE to assist with these inputs. However, material destined for the 820th is delivered to the BCE material holding area to allow CEMAS information to be updated, and must be reloaded and trucked five miles by the 820th for their use. In addition to this extra handling and wasted man-hours, materials are difficult to locate and may be inadvertently pulled by BCE personnel for use on their projects (20).

The lack of an automated interface makes it extremely difficult to make inquiries on the status of materials ordered, and the cost of all materials for each project or work order (20; 43). Another problem noted was mobility bag inventories. The high level of deployment exercise activity in RED HORSE squadrons makes inventories difficult to maintain. Bags are physically inventoried when drawn and returned, and an inventory card is placed in each bag with a copy in a central file. Shortages of mobility bag items are determined by manually reviewing each card and totaling the result for each item. Managers in both squadrons noted the difficulty in determining which bags were missing a certain size clothing item (20; 43).

Chief of Vehicle Maintenance. The Chief of Vehicle Maintenance makes decisions involving the daily management of the RED HORSE vehicle and equipment fleet. These managers need information from the operations branch indicating what equipment is required for each project, where it is going, when it is required and for how long (21; 31; 44). They interface with DOO to determine requirements for, and the maintenance status of, equipment and vehicles deployed on training projects. They also provide LGX with fleet status, including Estimated Time In Commission (ETIC) for equipment out of commission.

It was noted that the squadron's current information management system did not always provide a list of deploying vehicles in time for this section to adequately inspect and complete repairs and scheduled maintenance prior to departure (44). Project scheduling information could help these managers select mechanics to deploy on projects, make better budget forecasts, and develop personnel leave schedules (44). Also, fuel consumption data is required for each deployed vehicle to allow their Vehicle Information Management System (VIMS) to compute vehicle mileage and generate the corresponding scheduled maintenance requirements. Fuel consumption information is not always received for deployed vehicles. Upon return, when this information is input to VIMS, many vehicles are reported as overdue scheduled maintenance (44).

The current squadron information system does not provide an automated means of monitoring the status of parts ordered through the Contractor Operated Parts Store (COPARS). Much time and effort is expended conducting physical inventories to determine the COPARS performance and parts availability (31). The difficulty in determining parts status makes it hard for Maintenance Control to assign realistic ETIC to vehicles in maintenance. Finally, there is no means available for capturing and analyzing historical information to determine parts consumption rates or to estimate required stock levels for War Readiness Spares Kit (WRSK) (44).

Engineering Branch

Key managers in this branch are the Director of Engineering (DE), Chief of the Design Section (DEE), and the individual Project Engineers (PE) assigned to specific projects. Typical decisions made by the managers in this branch can be classified as

(1) Project Design and Planning - Which projects can we design? When and in what order? These are decisions made jointly by DE, DO, CD, and CC. What major activities must be accomplished? What manpower and equipment will be required? How much will it cost? These decisions are made by the individual PE's and DE.

(2) Personnel Scheduling - Who should I assign as PE? What is my design schedule? These decisions are made by DE from inputs by DEE.

Director of Engineering. The DE jointly with DO, CD and CC review project requests to determine their training value and feasibility for RED HORSE accomplishment. The DE needs design status from DEE, DEP, and the PE's to develop and maintain design schedules and present this status to the Commander and his staff in weekly project update briefings. Interviews with these managers indicated several problems of concern.

Perhaps the biggest problems facing these managers are the changing project priorities, delays in project designs accomplished by host bases, and frequent changes in the squadron's project schedule due to short notice exercise and project taskings by the Numbered Air Forces and MAJCOM. The existing information management system is too slow in providing accurate information needed to plan, design, and evaluate these changes in terms of the manpower, equipment, and resources required, or to develop and maintain design schedules (4; 11).

Another problem is the inability to collect and use historical project design and construction performance and cost data. Without this data, actual unfunded planning and design cost for each project is currently estimated with little or no certainty (4). Historical performance and cost data would help improve the speed and accuracy of project manpower, equipment, and cost evaluations and allow the development of unit cost estimates for various types of facilities such as roads and pre-engineered buildings to be used by other agencies considering projects for accomplishment by RED HORSE (4).

Chief, Design Section. Information needs for the Chief of Design are essentially the same as for the Director of Engineering. Key decisions involve the development and maintenance of the squadron in-house design schedule (11; 38). Again, changing project priorities, project delays, and short notice taskings make it difficult to maintain an effective design schedule (38).

Project Engineer. Key information needs for the Project Engineer are project design status, construction status, and the availability of manpower and equipment with which to plan the project's accomplishment. It was noted that project evaluations are time consuming and difficult to accomplish accurately due to insufficient cost information. Also, the project evaluations must be reaccomplished if the project is scheduled well beyond the original estimated start date. Construction activity charts (CPM and PERT) used to plan project activities are time consuming and usually lack the format or level of detail for making effective resource allocation decisions. Since they are manually constructed, they cannot be updated quickly for use in evaluating changes in a project's schedule. This limits their usefulness to managers both in the squadron and in the field (11; 40; 45).

Administrative Branch

According to policy regulations and interviews with squadron personnel, the key managers in this section are the Squadron Section Commander (CCQ), the Squadron First Sergeant (CCF), and the Chief of Administration (DA) (7:16; 25). These managers' decisions and decision-making information needs are presented in detail in Appendices C and B respectively, and are summarized below:

(1) Personnel Management - Is the squadron sufficiently manned? Should this individual be retained or allowed to re-enlist?

(2) Unit Administration - Are we meeting suspenses for performance reports, awards and decorations, and correspondence?

Squadron Section Commander. Squadron Section Commanders support the Commander "in controlling squadron discipline, morale, welfare, and mission performance" (17:16). They need personnel data maintained by the orderly room, Unit Career Advisor, and Unit Administration to provide recommendations to the Commander and section supervisors regarding discipline and retention of squadron personnel (25).

Squadron First Sergeant. Information needs for First Sergeants are similar to those for the Squadron Section Commander. These managers require easy access to individual personnel records.

Chief of Administration. These managers monitor the status of personnel actions, review and revision of squadron publications and policy letters, travel orders, and suspenses for correspondence, performance reports, and awards. They also monitor squadron administrative work loads and the use of word processing equipment (22; 34).

Funds Management

According to AFR 93-9, the Funds Manager "monitors squadron fund expenditures, recommends fund allocations, and coordinates preparation of unit budget" (17:16). The Funds Managers' decisions and decision-making information needs are presented in detail in Appendix C and Appendix B respectively, and are summarized as:

(1) Financial Management - Do sections have sufficient funds to accomplish their mission?

(2) Budget Formulation - What are our funding requirements?

The Funds Manager interfaces with managers of each branch and special staff to receive budget requests, and to monitor and adjust quarterly fund targets for each section. They also work closely with the Operations Center in monitoring project cost chargeable to squadron Operating and Maintenance funds (24; 27). They interface with the supporting host base Accounting and Finance Office, from whom they receive fund status information. They also receive reports from the host Base Supply indicating fund expenditures and status of contracts (24; 27). Interviews with these managers indicated several problems of concern.

According to MSgt Hall, Funds Manager for the 823rd RED HORSE, project cost accounting is his biggest problem area. "The [current squadron information management] system does not provide a systematic flow of information to tell how we are doing in regards to project cost control" (27). He monitors the cost of all projects accomplished by the 823rd and must get labor hours spent from DOO, and cost of materials received from LGS for cantonment projects. For projects at deployed locations, he depends on labor costs reported from the deployed project manager through DOO, and material costs reported by the BCE at the deployed location (18:4). As it may take weeks or months for this information to reach the squadron, current and accurate cost status for projects is nearly impossible to determine and frequent requests for additional funds must be made (24; 27).

TSgt Folle, Funds Manager for the 820th RED HORSE also feels project costing is a problem. While their Operations Center (DOO) performs most of the project cost accounting functions, the funds manager monitors project costs associated with training that are chargeable to the 820th. Information needed to monitor project costs comes from many sources and is not centralized, making it hard to track project cost (24). He feels his biggest problem is "trying to clarify section's funding needs" (24). Branches don't provide budget requirements clearly or in sufficient detail, and project costs estimates are not accurate (24; 27). The current squadron information management system does not provide a means for forecasting fund requirements based on the project schedule.

The amount of squadron funds required for TDY travel and materials is directly related to the level of project construction effort. When the squadron's project schedule changes, the type and amount of funds required to support that schedule changes. These managers need a way to forecast the funds required to support the changing project schedule to allow them to initiate corrective actions sooner and avoid constant reprogramming actions (24; 27). Also, funds managers expressed a need for an automated information system that provides an interface with host base functions such as Accounting and Finance, Base Supply, Base Contracting, and Base Civil Engineering; as well as the capability to make forecasts and present information in graphs (such as pie, bar or line charts), for use in briefings to the Commander and his staff (24; 27).

Training

The key manager in this section is the Chief of Training (OT) (10; 17:16; 46). His typical decisions are associated with:

(1) Training Scheduling - Who needs training, what type, and when? Who is available to fill this training quota?

(2) Training Monitoring and Reporting - What percent of our people have completed required training? Is this individual making satisfactory On the Job Training (OJT) progress?

Managers in this section work closely with the mobility plans section and rely on them to identify specific individual training needs for personnel assigned to the various squadron mobility teams. They need information from many sources to effectively schedule personnel for training. They need information from DA and the section supervisors that indicate which people are available for training, and information from DOO that indicates when personnel deployed are scheduled to return to the squadron (10; 46). They also interface with the MAJCOM and host base activities to request training quotas (10; 17:16).

Their biggest problems deal with scheduling individuals for training. Information on personnel availability for training is fragmented, and changes in the squadron's project schedule make it difficult to develop a meaningful training schedule. Personnel scheduled for training are often pulled for deployment on high priority projects, or delays in project accomplishment delay individuals returning to the squadron for training. The result is a high rate of missed appointments (10; 46). The Training Section can determine which individuals need training, but supervisors are often reluctant to allow the individual to be scheduled because of uncertainty as to if and when that individual will be needed for a particular project.

Unit Safety Office

The Squadron Safety Manager's decisions are generally semi-structured or structured. His primary information needs are for personnel and equipment information required to accomplish accident and ground mishap reports. Safety Managers maintain inspection records and suspense status for safety reports. They also analyzes historical accident data to predict accident trends and to make decisions regarding the type of accident prevention programs required in the squadron. One manager uses his home computer to analyze data due to the lack of automated support in the squadron (8).

Summary

Although many sections were acquiring and developing applications for Z-100, and Z-248 micro-computers, the programs and formats differed between the sections, making it difficult to share information. Information exchange was primarily through oral briefings and reports generated by the collecting section.

Detailed and voluminous information on projects, personnel, and training for these 400-man squadrons frequently caused managers to suffer from information overload. The squadron's current information systems do not provide a fast, reliable flow of information between sections. This creates an environment where most management decisions are made under conditions of uncertainty, even though the information is generally available in the organization.

V. ANALYSIS

This chapter presents the analysis that resulted from the research methodology outlined in chapter 3. This chapter will describe the different analysis techniques used in this research. The conclusions drawn from these analyses will be presented in the next chapter.

Decision Analysis

Interviews with managers in the RED HORSE squadrons indicated some of the typical decisions facing these managers and provided valuable insight as to their decision making information needs. The decisions were arranged in a decision matrix based on the taxonomy developed by Anthony and Simon (28:81). The matrix classified each decision as to the degree of structure and the level of management at which the decision is made. This analysis was used to identify those unstructured and semi-structured decisions that could best be supported by a DSS as well as the structured decisions that lend themselves to MIS support. This analysis was also used to determine specific information needs of the various managers in the RED HORSE squadron. The results of this analysis are presented in Appendix C.

Data Analysis

Managers in each section were interviewed to determine their essential decision-making information needs. These information needs were grouped into 19 areas of related information and arranged in a table that indicated the sections that used the information and those sections that provided the information. The results of an initial data analysis were forwarded to both squadrons for validation. Managers in the squadrons generally agreed with the results, but occasionally disagreed whether a specific information item was required, or whether they provided the information or simply used it. Such conflicts were resolved by listing the information item as being used by the manager. This analysis is presented in detail in Appendix B, but is summarized in Table 1 to indicate the types of information shared most often between the various sections in the squadron.

Using the data analysis in Appendix B, the number of information elements used in each information type was divided by the total number of information elements of that type to compute the percentage of information elements used by type for each manager. Table 1 indicates the areas where managers use 50 percent or more of the information elements in each information type. This table helps the reader visualize the relationships of various information types to the managers by indicating the heavy users of each information type.

Table 1. Summary Results of Data Analysis

TYPE OF INFORMATION	SECTIONS																	
	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	RM
Project Tracking	X	X	X	X	X	X	X	X	X	X		X	X	X					X
Project Design	X	X	X	X	X	X	X					X	X	X					X
Project Planning and Evaluation			X	X	X	X			X			X	X						X
Project Cost			X	X									X						X
Equipment/Vehicles	X	X	X	X	X	X	X	X	X	X	X	X	X						
Maintenance Supply									X	X									
Supply Equipment			X	X	X	X	X	X	X	X	X	X	X	X		X		X	X
Supply Clothing								X		X									
WRSK/WRM Mgt								X	X	X									
Supply Requisitions				X	X	X			X	X	X	X	X	X	X	X	X	X	X
Tool Issue					X	X			X	X									
Residual Materials				X	X	X				X			X						X
Mobility/Readiness	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			
Financial Mgt	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Individual Personnel	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Personnel Mgt	X	X	X				X	X			X	X	X		X	X	X	X	X
Administration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Training	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Hazard/Mishaps	X	X	X				X		X			X			X	X	X	X	X

X indicates the manager uses 50 percent or more of the information elements in this type.

The results also indicate a strong need for sharing information between different sections. The degree to which information is shared between sections was determined by totaling the number of sections using or providing each information element and averaging the totals for each information type. Table 2 lists the ranking of information types in order of increasing users.

Table 2. Ranking of Information Shared by Sections

RANK	INFORMATION TYPE	RANK	INFORMATION TYPE
1.	Individual Personnel/ Financial Management	10.	Hazard/Mishaps
2.	Training Status	11.	Equipment/Vehicle Management
3.	Administration	12.	Project Planning and Evaluation
4.	Mobility/Readiness	13.	Residual Material
5.	Project Tracking	14.	Project Cost
6.	Supply Equipment	15.	Tool Issue
7.	Project Design	16.	WRSK Mgt
8.	Supply Requisition	17.	Supply Clothing
9.	Personnel Administration	18.	Maintenance Supply

Descriptive Model

The findings generated by this research indicate two major activities of the squadron: (1) Accomplishing troop training projects, and (2) maintaining a combat engineering deployment capability. This section will begin with the development of a descriptive model that indicates key decision making processes associated with these activities. In the next section, a normative model is developed to identify decision-making processes that could be improved through automation. Figures 7 through 12 describe the descriptive model for project program execution.

To maintain proficiency in their wartime engineering skills, RED HORSE squadrons accomplish construction and heavy repair projects for other bases. Various bases send their project requests to the RED HORSE squadron through their parent MAJCOM and HQ AFESC (17:31). These requests are reviewed by the RED HORSE Commander, Deputy Commander, and the Operations and Engineering managers to determine whether the project is feasible and provides valuable training (Figure 7). If accepted, the project is logged into the Operations Center (DOO) and forwarded to the Engineering Branch (DE) for evaluation.

The DE assigns a Project Engineer (PE) to manage the design and evaluation effort (Figure 8). The PE performs a pre-design evaluation of the project to estimate the manpower, equipment, materials, and funds required to accomplish the project (18:2). This information is provided to the Operations Branch to allow the project to be initially scheduled in the troop training project schedule. The PE also serves as the primary point of contact with the host base to ensure the required host base material, design, and funding are provided to support the project. The DE reviews the project's scope in more detail and decides whether the project should be designed by the requesting BCE or by RED HORSE, based on his in-house design schedule and his section's projected tasking (4; 11).

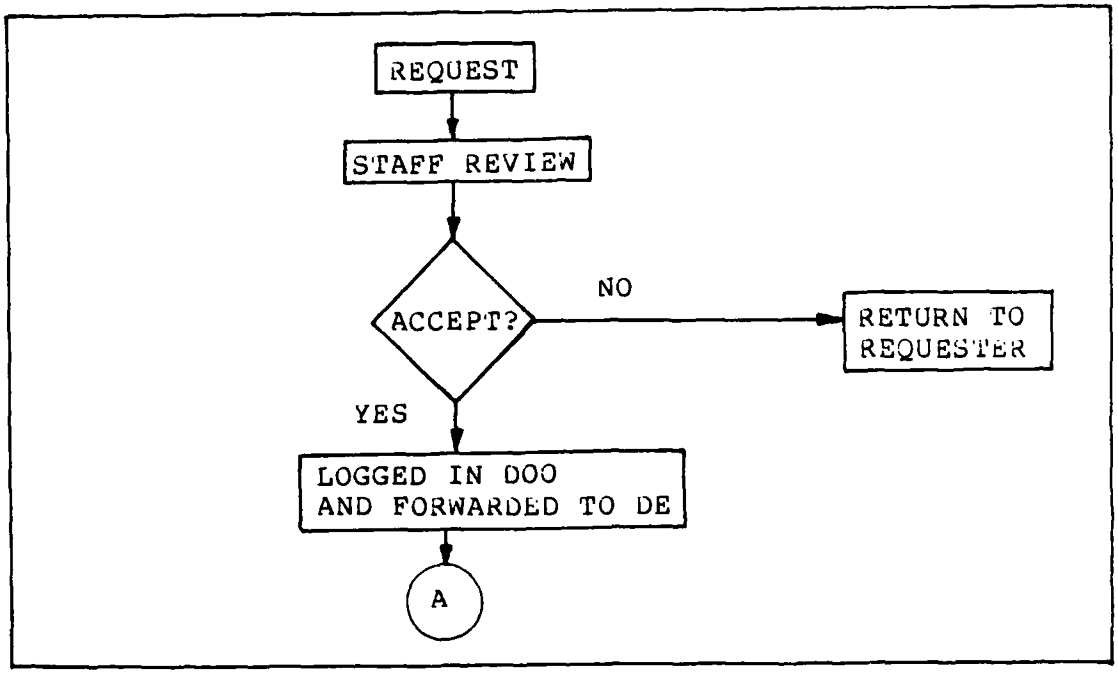

Figure 7. Receipt and Review of Project Requests

Upon the completion of the project design, the PE performs another project evaluation which is based on a detailed Bill of Materials (BOM) and a Critical Path Method (CPM) analysis of the manpower and equipment that will be required during construction. The PE must check with the Airfields Flight (DOP) to see if RED HORSE equipment will be available to support the project. If not, he calls the host base at the project location to get information on the availability of BCE and local rental equipment. In some cases, it may be cheaper to rent equipment locally than to transport RED HORSE equipment. Also, mobility requirements affect the decision of whether to deploy RED HORSE equipment and vehicles. The PE makes a detailed estimate of the funded and unfunded costs based on the travel, per diem, and labor cost of the personnel deploying; the cost of materials; the operating cost and depreciation of RED HORSE equipment to be deployed; and the rental costs for equipment that will be obtained at the project location (18:2). The PE drafts a list of men and equipment required for each project, indicating personnel required by Air Force Specialty Code (AFSC) and equipment required by type, and the dates required. The DE forwards the project evaluation package to the Operations Center (DOO).

The Operations Center updates the troop training project schedule based on the updated project evaluation. When the project is within 12 months of it's estimated start date (ESD), it is inserted into the schedule as directed by the Commander (45). The scheduler inputs the project requirements into an In-house Work Plan (IWP) spreadsheet to check the feasibility of the new schedule according to manpower and equipment availability. Other projects affected by the schedule change are rescheduled as directed by the Commander until a feasible project schedule is obtained. Figure 9 describes the project scheduling process.

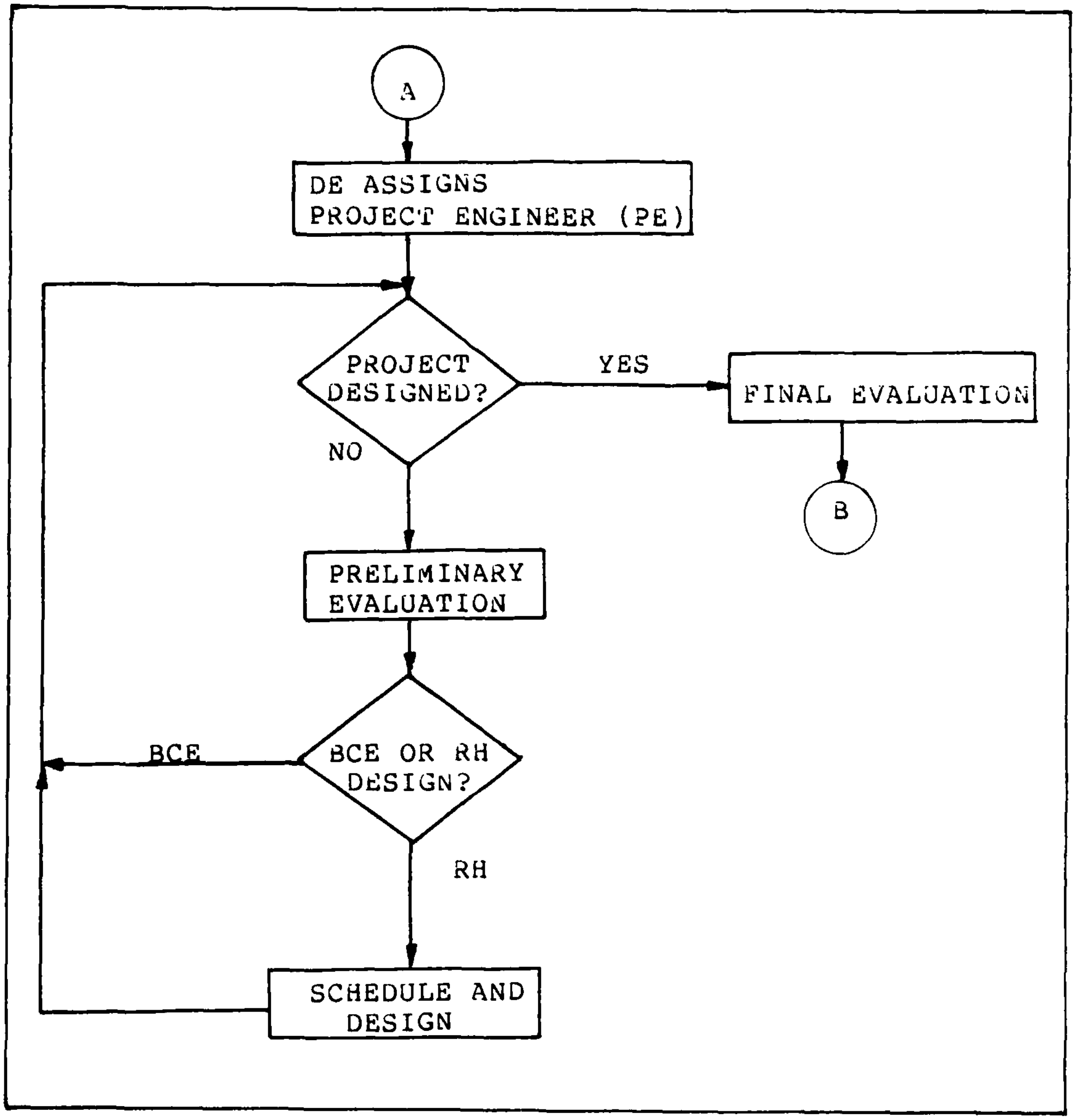

Figure 8. Project Design and Evaluation

When the project's ESD is within one month, DOO will forward the crew lists and equipment lists to the Cantonment (DOS) and Airfields (DOP) flights to make personnel and equipment assignments to crew lists indicating the specific names and AFSC's of personnel selected to deploy.

Generally, the supervisor makes the assignment after consulting with an assignment board on the shop wall to verify that the individual desired is available, and not

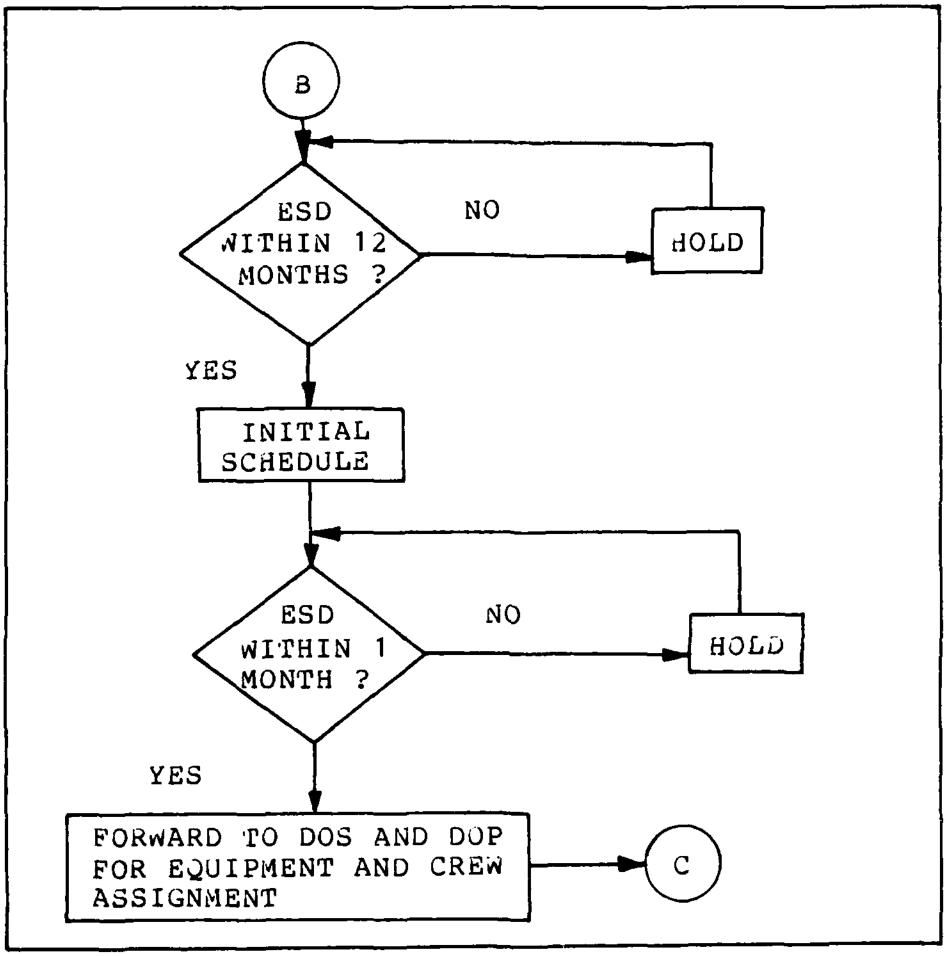

Figure 9. Project Scheduling

scheduled for another project during the same time period (Figure 10). The supervisor must also check the individual for overdue or scheduled training and appointments. The vehicle dispatch section in DOP uses a similar method to assign equipment by type and registration number. The completed personnel and vehicle lists are then forwarded to the Project Manager, who is the ranking member of the deploying team.

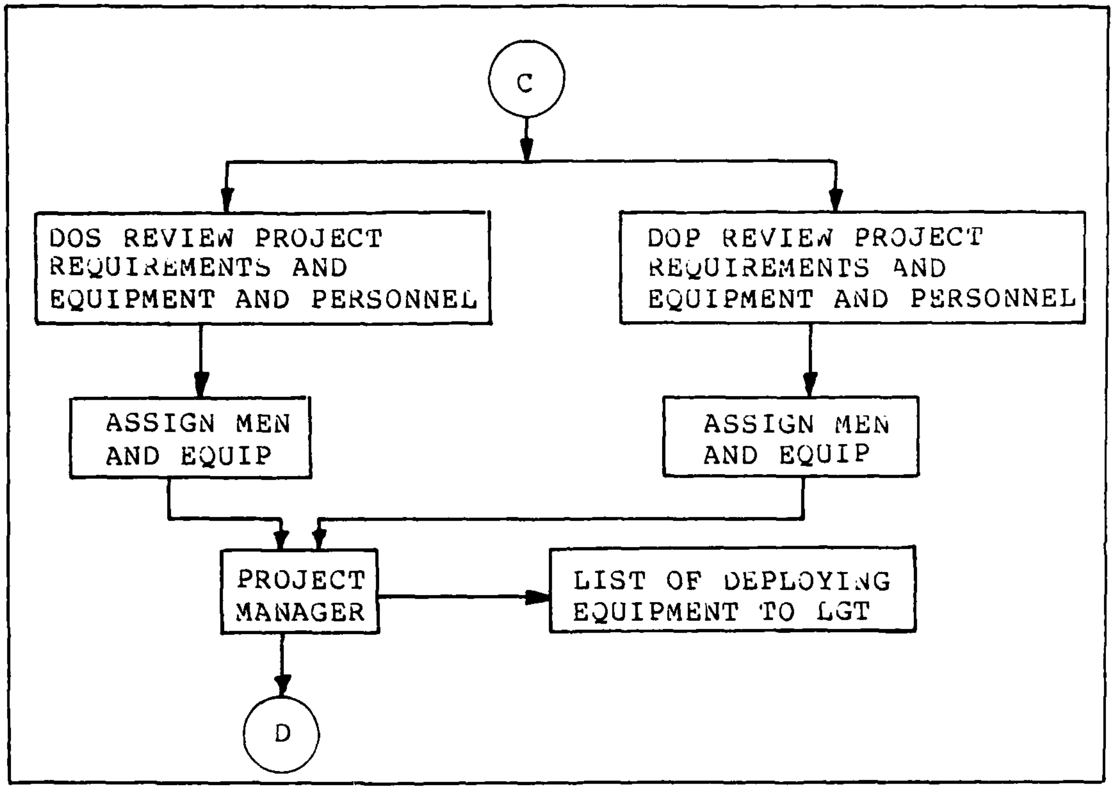

Figure 10. Equipment and Personnel Selection

The Project Manager (PM) provides a list of deploying equipment to the vehicle maintenance section and coordinates the final crew list with other squadron sections. The PM coordinates the final crew list with the Logistic Plans Section (LGX) to resolve any conflicts with scheduled mobility training and to ensure each member on the deploying team has an alternate available in the squadron to backfill his mobility team position. For example, if an individual is assigned to the RH-1 mobility team, and his alternate is not available, the individual cannot deploy and the crew list must be reaccomplished. The Training Section (OT) reviews the crew list to determine if deploying individuals are scheduled for, or overdue, individual training requirements. If there are conflicts, OT attempts to schedule the individual for training prior to departure or arrange for the individual to receive training at the deployed location. This is extremely difficult to do on short notice and may cause the crew list to be reaccomplished to replace the affected individual. The Director of Operations reviews the equipment and crew lists to ensure they are complete, that they do not conflict with other resource requirements such as exercises or other projects, and that the commitment of these resources will not degrade the readiness posture of the squadron. This coordination process is indicated in Figure 11.

DOO and the PE continue to monitor project status, such as funding and material support, up to the time that the crew is scheduled to deploy. Normally, materials for projects at deployed locations are ordered and stored by the host BCE. Prior to the team deployment, DOO contacts the host base to confirm that all required support is available. If the required support is not available, such as 100 percent materials on hand, then a new ESD is established and

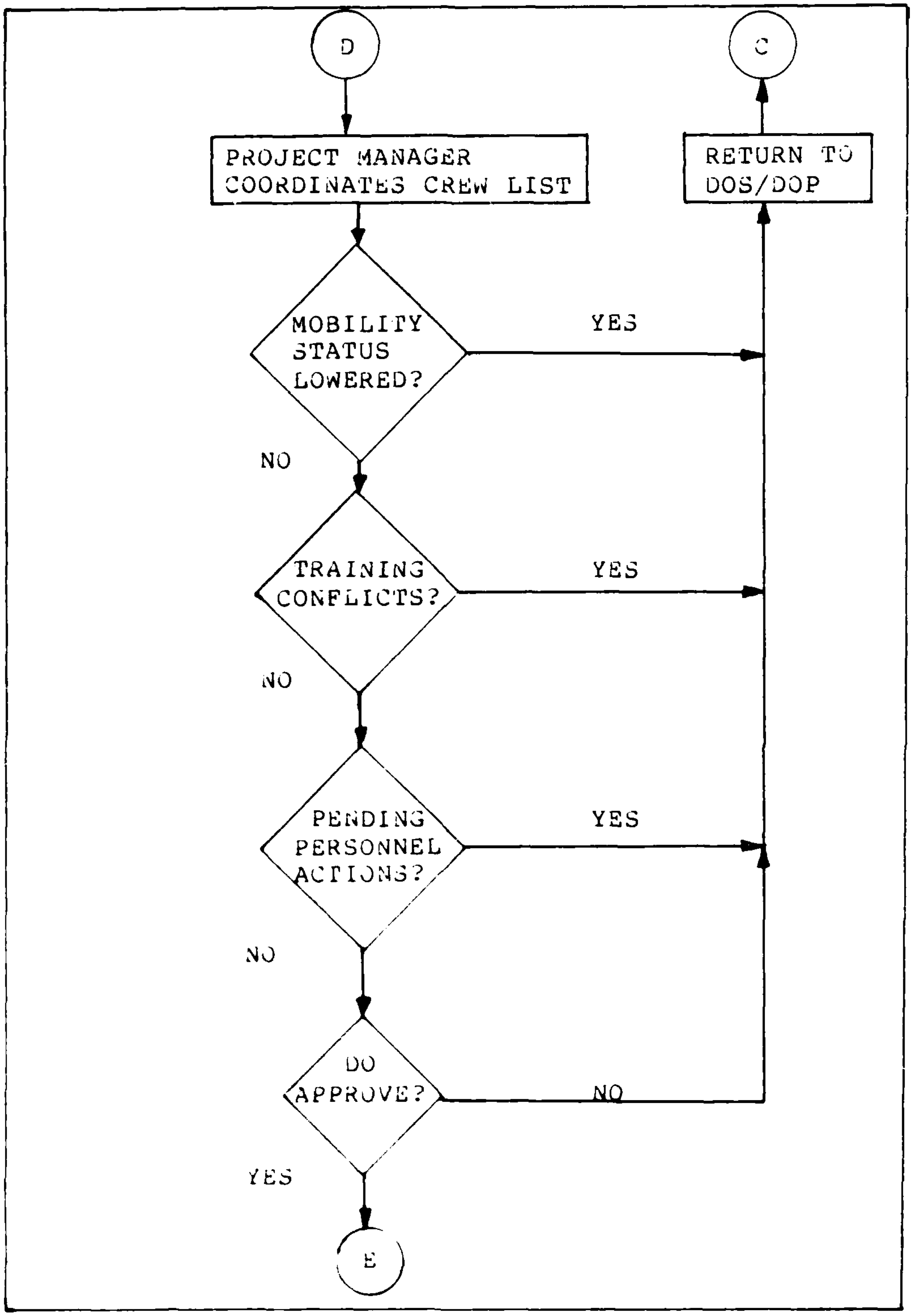

Figure 11. Project Crew Pre-deployment Coordination

the project is rescheduled. Significant delays in a project's ESD may affect personnel and equipment availability. In such cases, the personnel and equipment lists must be revised and the coordination with other sections repeated (Figure 12). If the project is supportable by the host base, the team's personnel and equipment are prepared for deployment.

The DO works with the Project Manager to decide the mode of transportation for the deploying crew based on the project needs and a comparison of the costs of travel by commercial or government airlift or government, rental, or private vehicles. The Project Manager drafts the TDY orders, coordinates with the Funds Manager for the proper fund cite, and delivers them to DA for processing. When all personnel and equipment preparation is completed the team deploys.

During the construction phase, the deployed Project Manager tracks labor and materials expended and provides this information to the Operations Center during weekly project updates, both by mail and by telephone (47). If determined that additional manpower or equipment is required, the Project Manger makes a request to DOO, who coordinates the request with DOP and DOS, and the above process is repeated.

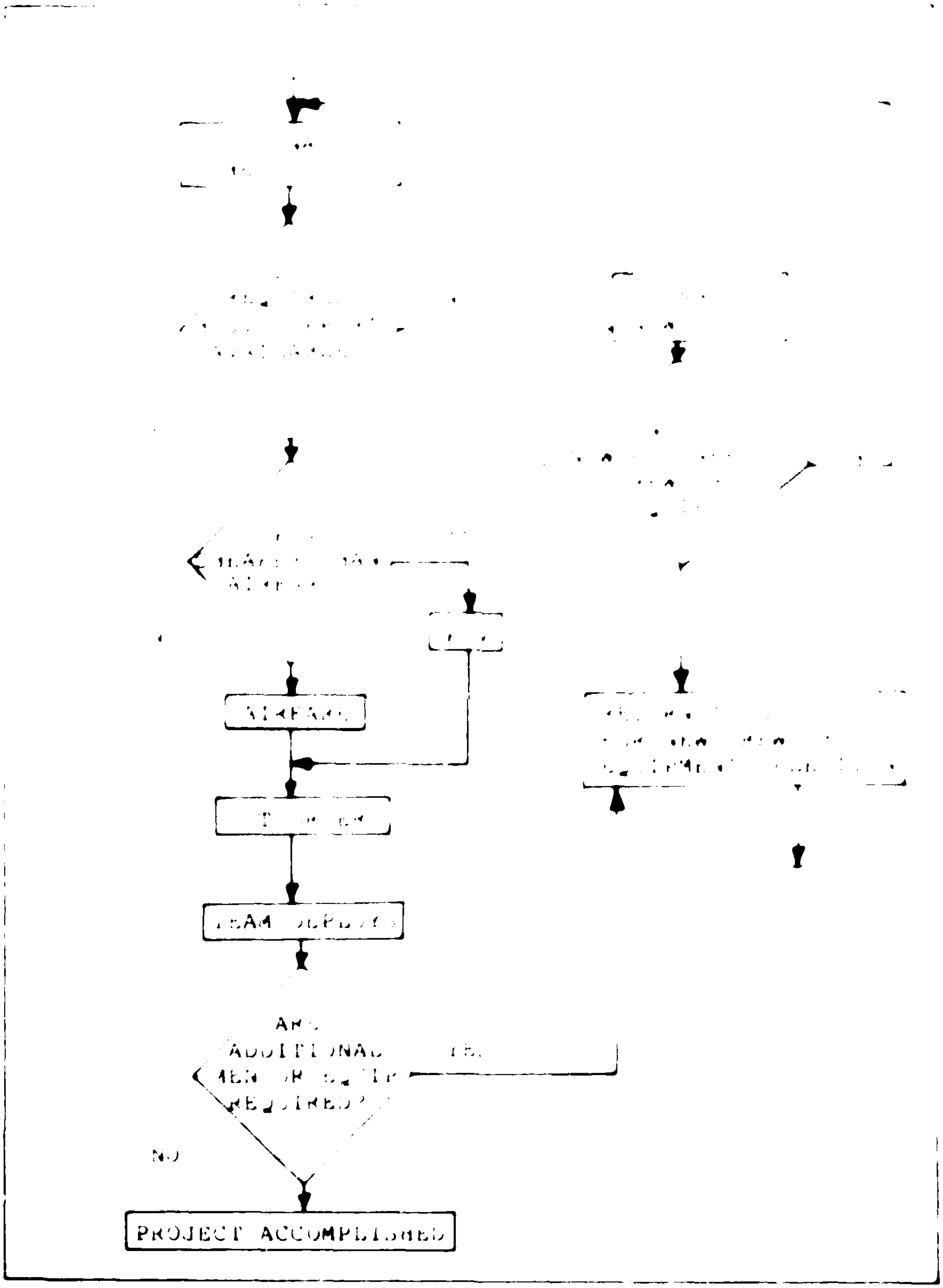

Figure 12. Rescheduling and Deploying the Team

Normative Model. The descriptive model for the execution of the troop training program, developed above, describes the process by which project requests are reviewed, evaluated, approved, scheduled, and executed. In the next section, some of the key decisions that might be supported by DSS applications were analyzed using the ROMC approach to determine the DSS capabilities required by the managers making those decisions. The proposed normative model is essentially the existing process, supported by MIS and DSS at key points in the process to improve decision making.

The first point in the execution of the RED HORSE troop training project program recommended for automated support is the engineering design and evaluation process. Here, an automated design scheduling module (a DSS application) could assist the DE in assigning engineers to the various projects, and in developing an effective design schedule, that could be easily updated as project priorities change. This module could provide design scheduling and status reports (an MIS application) to the various squadron managers. A cost estimating module could draw labor hours, and materials cost data from a historical database or from Engineering Performance Standards (EPS) to help engineers in performing project evaluations. Anotner DSS anplication is a project planning module that would provide automated project management support, such as Critical Path Method

(CPM) and Project Evaluation and Review Technique (PERT), to provide a visual representation of the manpower and equipment required throughout the project duration.

The next point in the project evaluation process is recommending equipment to be deployed by RED HORSE, equipment to be provided by the host BCE, and rental equipment. Here, the engineer needs a list of RED HORSE equipment and vehicles projected to be available in the timeframe the project is scheduled for accomplishment. This module would assist the engineer in selecting RED HORSE equipment by comparing the cost of deploying squadron equipment with the cost of renting equipment based on the transportation distance and operating hours required. This module should also have the capability to project fuel and other operating costs as well as equipment depreciation costs from data in an equipment database.

The initial project scheduling process also lends itself to MIS and DSS support. Here it is proposed that RED HORSE squadrons use a work scheduling module, similar to that developed for the BCE WIMS system. Since availability of heavy construction equipment severely constrains the project scheduling decision, the module should generate recommended project schedules based on both manpower and equipment availability. This scheduling module would allow alternative project schedules to be evaluated (a DSS application) and provide data on the current project schedule to all squadron sections (an MIS application).

The current process of evaluating and scheduling projects is too slow to react to changes in the project schedule. DOO often receives project evaluations within one month of the project start date. It has been suggested that evaluations should be completed at least two months prior to the project start to allow adequate time for personnel and equipment preparation. A scheduling module could improve the current process by reducing the time required to develop new project schedules, and allowing equipment and crew lists to be developed sooner. The Vehicle Maintenance Section could get advanced information regarding equipment scheduled to deploy, and thus would have adequate time to inspect and repair them. Individuals would get more advance notice of their deployments, allowing them to complete required training and personal actions, and reduce the stress imposed on their families due to short notice TDYs.

The personnel and equipment assignment process could also benefit from DSS support. Here the system could support managers by checking individuals assigned to a crew list against master training and personnel databases for potential conflicts with training, appointments, administrative actions, and other considerations, such as leave schedules and time away from station. Moreover, every piece of equipment assigned to a project could be checked against a master equipment and vehicle database for conflicts with scheduled maintenance and other project tasking. Furthermore, every proposed project deployment could be analyzed to determine the overall impact on training schedules and squadron mobility readiness status, allowing managers to make earlier adjustments to maximize squadron readiness. The use of automated support in these processes would eliminate much of the time spent coordinating the crew list with the various sections (Figure 11).

Following the assignment process, the Director of Operations reviews the final schedule, and approves or modifies it. Here a DSS could aid his decision by providing an overall picture of squadron mobility, training, manning, equipment, and funding status based on a given project schedule. This module should allow the manager to examine the impacts to these various items from changes in the project schedule. The system should be flexible to allow various managers to make inquiries ranging from the very detailed (such as the names of personnel deploying on a certain project) to the aggregate (such as the total number of deploying personnel for a given period).

The next point in the process where a DSS could be applied is in deciding the least cost mode of travel for deploying personnel. Here a cost analysis model could be used to compare the cost of airfare with the cost of POV travel based on the location, travel distance, and historical cost data.

Coordination with the Funds Management Section for funds required to support a project deployment could also be improved through MIS/DSS support. The current squadron information systems do not allow the Funds Manager to assess changes in funds required caused by changes in the level of project activity. A DSS financial forecasting module is required. This module would use project cost information provided by the project evaluations to determine the funds required by Element of Expense Investment Code (EEIC) for each quarter, based on the current project schedule.

The final point in the process, rescheduling, could be improved through the use of two DSS applications mentioned previously. First, the Operations Center could use the CPM information provided in the project planning module to evaluate changes in a project's estimated completion date (ECD). Deployed project managers could telephone DOO to report changes in project milestones (e.g. a six day delay in pouring concrete for a building foundation). DOO personnel could access the CPM for that project, change the activity start times, and the system would analyze and report new milestones and project completion dates. Secondly, DOO could use the scheduling module to evaluate changes in the total project schedule caused by changes in an individual project's ECD.

<u>ROMC</u> <u>Analysis.</u> The descriptive and normative models developed above and typical decisions associated with this

process (Appendix C) were used to determine the general system requirements for supporting various decisions. Several critical semi-structured decisions were selected for this analysis. These are listed in Table 3.

Table 3. Decisions Selected for ROMC Analysis

1. Considering the affect on mobility team readiness, should I approve this project schedule?
2. Can we design this project In-house? Who should I assign as Project Engineer? How should I assign engineers to this design effort?
3. How should we distribute squadron obligation authority? What are our quarterly fund requirements?
4. What stock levels should we establish for our War Readiness Spares Kits (WRSK)?
5. Who should I assign to this project deployment?
6. Considering that possible changes in a project start date may cause deployed personnel to miss scheduled training, should I approve this project crew list?
7. What equipment and vehicles should we deploy? What vehicles should we borrow or rent?
8. When should this project be scheduled?
9. When should this training be conducted? How many training quotas do I need? Who should I schedule for this training?

First, key decisions were analyzed in terms of Simon's three stages of decision-making to determine the Intelligence, Design, and Choice activities performed by the decision maker. Then, the detailed Requirements, Operations, Memory aids, and Control mechanisms required of a DSS to support those activities were determined. This ROMC analysis is rather lengthy and is included in Appendix D, ROMC Analysis Results.

Risk Analysis for Implementation

The findings generated from this research were used to identify the differences between the existing RED HORSE squadron environment and the "ideal implementation situation" as recommended by Alter (2:155,158). Under Alter's ideal implementation environment

> the system is to be produced by a single implementer for a single user who anticipates using the system for a very definite purpose that can be specified in advance with great precision. Including the person who will maintain it, all parties affected by the system understand and accept in advance its impact on them. All parties have prior experience with this type of system, the system receives adequate support, and its technical design is feasible and cost-effective. (2:157)

Comparing this environment with that in a typical RED HORSE squadron indicates eight primary differences or risk factors:

1. Multiple Implementers. Interviews with HQ AFESC, HQ TAC, and RED HORSE squadron personnel indicated some confusion as to who would implement automated management systems in the RED HORSE squadrons. RED HORSE squadrons lack the expertise required to implement automated management systems and must rely on assistance from other organizations. Problems may occur when attempting to incorporate the interests of the squadron users, the MAJCOM, and HQ AFESC.

2. Multiple Users. Different managers within the squadron have different decision-making information needs and different decision-making and management styles. These individual differences must be considered during design and implementation to facilitate user acceptance and ensure the system meets the individual manager's needs. Also, the system will require data to be provided by many different sections. Individuals in the various sections may provide data in a "feeder role" (2:163), but may not directly benefit from it. Thus, they may lack motivation to provide accurate and timely inputs.

3. Lack of a Clear Predefined Purpose. Managers in the RED HORSE squadron generally have a good idea of their own section's information needs, but do not fully understand or appreciate the information needs of other sections in the squadron. To implement a well integrated system, these needs must be explored and the system's purpose, applications, capabilities and limitations must be understood by all users. This research is designed to explore user needs and can be used as a basis for defining the purpose of the system.

4. User Acceptance. As mentioned in Chapter 1, the WANG mini-computers provided to the 820th and 823rd RED HORSE squadrons were not totally accepted. Managers in these squadrons were reluctant to support the cost of installing, operating, and maintaining the system because

they could not see the benefits of the system and were not provided adequate support to implement the system. The system was basically a forced implementation, with little to no user initiation or participation.

5. Lack of Prior Knowledge of the System. RED HORSE squadrons lack prior experience with the more complex automated information management systems like BEAMS or WIMS. However, they are developing some experience with "stand alone" micro-computers such as the Z-100 and Z-248. Users will most likely have problems understanding the capabilities of a new system and the use of its applications software. This may lead to disuse (not using the system) or misuse (using the applications the wrong way).

6. Uncertainty of Funding Support. The initial costs for implementing the new system will likely be too high for the squadron to absorb alone. Inadequate funding may delay the implementation effort or cause users to resent the system as being a financial millstone around their necks. The estimated operating and maintenance cost for the new system should be determined during the design stage so that the squadron can budget for them early.

7. Uncertainty of Operating Support. As mentioned previously, the RED HORSE squadron environment is characterized by a constantly fluctuating work force as people are moved from one project or exercise to another. Because RED HORSE personnel are subject to a high level of

TDY, managers are concerned that trained operators will not be available to operate the system (12).

8. Uncertainty of Technical Design Feasibility. Because of their lack of experience with automated information management systems, and ill-defined information needs, the new system may not be designed to provide the right support to the right problems. If squadrons are to develop the system on their own, it may not incorporate available technology or achieve the level of integration required to provide full squadron support.

9. Uncertainty of Cost Effectiveness. Considerable resources may be invested in the development of a new system, only to find that advances in technology provide a better alternative. Also, it is difficult, if not impossible, to put a dollar value on increased effectiveness of decision-making.

VI. CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the conclusions drawn from the analysis presented in the previous chapter. The conclusions and recommendations from this research will be discussed for the three research objectives: [1] identify areas where MIS/DSS systems should be applied, [2] provide recommendations for the development of specific DSS applications, and [3] provide recommendations for the implementation and long term development of these systems.

Identify MIS/DSS Application Areas

The analyses described in Chapter 5 were used to satisfy the first research objective. The Data Analysis of Information Needs (Appendix B) was used primarily to identify MIS applications. The Key Decision Matrix (Appendix C) was used to identify those semi-structured and unstructured decisions best supported by DSS. DSS applications were identified for the decision-making processes described in the normative model. Table 4 summarizes the various automated management applications recommended for RED HORSE squadrons. These applications are presented for each key manager in the RED HORSE squadron.

Commander. The Commander's primary decisions are unstructured and semi-structured. While these decisions require a large degree of intuition on the part of the [illegible], they also require current and accurate information [illegible] changes regarding the status of [illegible], personnel, equipment, materials, and funds. [illegible] management styles and the fact that commanders want generalized information in the form of performance indicators suggest a need for a system that allows reports to be easily formatted to provide information tailored to the individual commander's needs. Also, since key managers are dispersed in various buildings throughout the squadron and subject to a lot of TDY, an electronic mail utility would allow commanders to leave messages, tasking, and inquiries for his staff pending their return.

<u>Deputy Commander.</u> Most of the Deputy Commander's decisions are unstructured and semi-structured. The recommended MIS applications are essentially the same as for the Commander, with more detailed report information concerning project planning and design, construction, personnel, equipment, training, readiness, and squadron financial status. DSS applications include a module for projecting Special Operational Readiness and Training Status (SORTS) readiness data based on the project program schedule. Also, access to the project scheduling module would allow him to assess the impact of schedule changes on training, personnel, and equipment availability.

AD-A187 627 POTENTIAL INFORMATION AND DECISION SUPPORT SYSTEM 2/2
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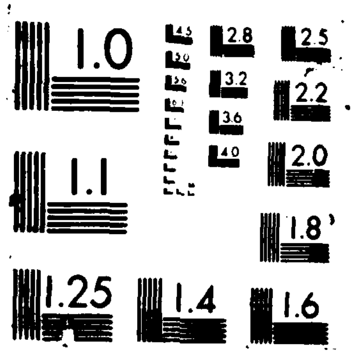
1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

Table 4. Summary of RED HORSE Automated Management System Applications.

MIS APPLICATIONS	
Project status reports	Material status
Personnel status reports	APR and Award suspenses
Vehicle and equipment status	Leave projections
Financial status	Labor accounting reports
Training rosters	Mobility equipment inventory management
Mobility readiness status	
DSS APPLICATIONS	
Automated CPM networks	Travel cost analysis
Project evaluations	Project crew selection
Readiness forecasting	Project equip selection
Project scheduling	Mobility load planning
Financial forecasting	Design scheduling
Training scheduling	Design and construction cost estimating
Stock level estimating	
OTHER	
Electronic mail	
Word processing	

<u>Director of Operations.</u> The DO is primarily faced with semi-structured decisions. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, availability of branch personnel, equipment status and long-

range availability, training schedules for branch personnel, branch APR and award suspenses, mobility team status, and branch financial status. Several DSS applications are recommended for this manager. First, the automated CPM planning module used by the Project Engineer to determine project construction schedules could be used by the DO to evaluate the affect of changes in the construction schedule on the manpower and equipment resources used by the project, and to compute new activity start and completion dates. The equipment planning module, used by DE to recommend RED HORSE equipment for deployment, could be used to determine the feasibility of deploying additional equipment required during a project deployment. A project scheduling module could be used to evaluate alternative project schedules and determine the impact on equipment and personnel availability as well as scheduled training for branch personnel. A SORTS readiness forecasting module could be used to give the DO a graphic representation of the squadron's projected readiness rating over time based on a given troop training program schedule. The DO could also benefit from a financial forecasting module that could combine expenditures by each section and display graphic representations of planned versus actual fund expenditures and estimated expenditures for the branch based on historical data. Finally, the DO could use a travel cost analysis module to determine the most cost effective mode of travel for deploying individuals.

Chief, Operations Center. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, availability of branch personnel, equipment status and long-range availability, detailed training and personnel information for section personnel, and project and work order material cost and availability information. In addition, an automated labor accounting module, similar to that developed for WIMS, is recommended to automate the preparation of weekly work schedules, manhour accounting, labor reporting, and the preparation of the In-house Work Plan (IWP). Several DSS applications are recommended for this manager. First, the automated CPM planning module, used by the Project Engineer to determine project construction schedules, could be used by the DOO to update project status as progress reports are received from deployed project managers. He could evaluate the affect of changes in the project's construction schedule on the manpower and equipment resources used by the project and to compute new activity start and completion dates. This information could be provided to the Project Manager and used to update the troop training program schedule. The project scheduling module could be used to develop alternative project schedules for the troop training program to better utilize equipment and personnel resources.

Chief, Cantonment Flight. The Chief of Cantonment Flight is primarily faced with structured and semi-structured decisions. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, availability of section personnel, training schedules for section personnel, section APR and award suspenses, OJT status for section personnel, mobility team assignments, and section financial status. Several DSS applications are recommended. First, the automated CPM planning module could be used to provide detailed manpower and equipment requirements for each day of the proposed project. These managers could use this information to make better crew assignments, resource leveling, and for recommending changes to accelerate job progress. This manager would also benefit from a personnel scheduling module that would help match available personnel with project requirements after checking for conflicts with scheduled leave, training, or other appointments.

Chief, Airfields Flight. Recommended MIS applications are essentially the same as for the Chief of Cantonment Flight, but should include detailed reports of equipment and vehicle status including scheduled maintenance and long-term availability, and project and exercise taskings for all equipment assets. DSS applications for this manager are the same as for DOS.

Director of Logistics. The LG is primarily faced with semi-structured decisions. Recommended MIS applications include reports to provide information concerning project status, material status, availability of branch personnel, equipment status and long-range availability, training schedules for branch personnel, branch APR and award suspenses, mobility team status, and branch financial status. Several DSS applications are recommended for this manager. First, the SORTS readiness forecasting module could be used to give the LG a graphic representation of the squadron's projected readiness rating over time based on a given troop training program schedule. The LG could also benefit from a financial forecasting module that could combine expenditures by each section and display graphic representations of planned versus actual fund expenditures and estimated expenditures for the branch based on historical data.

Chief, Logistic Plans. The Chief of Logistic Plans is primarily faced with structured and semi-structured decisions. Recommended MIS applications include reports to provide information concerning project status, mobility team assignments, availability of squadron personnel, squadron training status, status of mobility equipment and increments, training schedules for section personnel, section APR and award suspenses, OJT status for section personnel, and section financial status. In addition, an

MIS system for monitoring the status of personnel and equipment preparation during exercises or contingency deployments could greatly benefit these managers.

Such a system should allow all sections to report manning status on their terminals during recalls. The system would aggregate the information by shop and mobility team. Required processing events and completion times could be displayed on terminals in each section and at the mobility processing check-points. Each section and check-point could input the status of their required actions and the system could compute new estimated completion times and flag problem areas.

Several DSS applications are recommended for this manager. First, an automated load planning module similar to the existing micro-computer based Contingency Operations/ Mobility Planning and Execution System (COMPES) should be provided to allow load plans to be quickly developed for various aircraft and cargo requirements. The SORTS readiness forecasting module could be used to aggregate personnel, equipment, and training information into the monthly SORTS readiness report and to provide a graphic representation of the squadron's projected readiness rating over time based on a given troop training program schedule. It could also help managers evaluate the effect that changes in mobility team personnel assignments would have on the SORTS rating.

Chief, Supply Section. The Chief of Supply is primarily faced with structured and semi-structured decisions. Recommended MIS applications include reports to provide information concerning project status; availability of section personnel; status of materials, equipment, and weapons maintained as mobility increments; training schedules for section personnel; section APR and award suspenses; OJT status for section personnel; and section financial status. In addition, the MIS system should be capable of direct interface with the host base BCE and Base Supply automated systems for ordering materials, making inquiries, monitoring status of materials and equipment on order, and obtaining cost and fund status reports.

Other MIS applications include automated inventories of mobility equipment and individual mobility bags to help cut down the time required to inventory, order, and fill personnel clothing shortages. A transaction-based MIS system for material issues and returns could also help this manager better control materials, while providing real-time residual material stock levels to planners developing Bill of Material (BOM) for RED HORSE projects. One potential DSS application is a module for estimating material requirements based on historical data.

Chief, Vehicle Maintenance Section. The Chief of Vehicle Maintenance is primarily faced with structured and semi-structured decisions. Recommended MIS applications include reports to provide information concerning project schedules, project status; equipment and vehicles scheduled for deployment; status of equipment maintained as mobility increments; availability of section personnel; training schedules for section personnel; section APR and award suspenses; OJT status for section personnel; and section financial status. The MIS system should be capable of direct interface with COPARS for ordering parts; making inquiries; monitoring status of parts and equipment on order; and obtaining inventory, cost, and fund status reports. In addition, the system should provide a direct interface with the host base VIMS system for transferring vehicle maintenance information. This would prevent users from having to duplicate data entry into both systems. Potential DSS application areas include a module for estimating WRSK and COPARS parts and material stock levels based on historical consumption data and a module to assist managers in developing work schedules based on vehicles scheduled for deployment, scheduled maintenance, and personnel availability.

Director of Engineering. The DE is primarily faced with semi-structured decisions. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, availability of branch personnel, equipment status and long-range availability, training schedules for branch personnel, branch APR and award suspenses, mobility team status, and branch financial status. In addition, the automated system should provide automated engineering labor accounting to allow planning and design costs to be computed and charged against each project. Several DSS applications are recommended for this manager.

First, an automated design scheduling module could be used to develop the RED HORSE in-house design schedule based on project design requirements and the availability of engineers. A design manhour estimating module could be used to estimate the number of design hours required for each project by skill based on historical labor accounting data. The automated CPM planning module used by the Project Engineer to determine project construction schedules could be used by the DE to review construction schedules and recommend changes to better utilize manpower and equipment resources. A project scheduling module could be used to evaluate the effect design schedules have on the troop training program schedule. As the RH-1 mobility team Commander, the DE could use the SORTS readiness forecasting module to produce a graphic representation of the squadron's projected readiness rating over time, based on a given troop training program schedule. The DE could also benefit from a financial forecasting module that could combine expenditures by each section and display graphic representations of planned versus actual fund expenditures and estimated expenditures for the branch based on historical data. Finally, the DE could use a travel cost analysis module to determine the most cost effective mode of travel for deploying individuals.

Chief, Engineering Design Section. The MIS/DSS applications for the Chief of Design are essentially the same as for the DE.

Project Engineer. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, availability of squadron personnel, equipment status and long-range availability. Several DSS applications are recommended for use by the Project Engineer. First, A construction cost estimating module could be used to estimate the manpower and equipment required for a project as well as the estimated costs. An automated CPM planning module could be used by the Project Engineer to determine project construction schedules, manpower and equipment resource requirements by day, and activity start and completion dates. The equipment planning module could be used by PE to recommend RED HORSE equipment for deployment.

Headquarters Squadron Section Commander. The Squadron Section Commander's primary decisions are unstructured and semi-structured. While these decisions require a large degree of intuition on the part of this manager, they can best be supported by MIS applications that provide detailed and accurate personnel information on all individuals assigned to the squadron. The system should also provide reports on personnel availability, squadron APR and award suspenses, status of personnel actions, and financial status information for his section.

Squadron First Sergeant. The MIS/DSS applications for the First Sergeant are essentially the same as for the Headquarters Squadron Section Commander.

Chief, Unit Administration. The Chief of Administration's primary decisions are well structured. Most of this manager's decision-making needs can best be supported by MIS applications that provide detailed personnel information; and status on correspondence, APRs, and awards.

Funds Manager. The Funds Manager is primarily faced with semi-structured decisions. Recommended MIS applications include reports to provide information concerning project planning and design status, construction status, squadron fund expenditures by section, labor hours against projects, material costs for projects, availability of section personnel, training schedules for section personnel, section APR and award suspenses. In addition, the automated system should provide an interface with the host base finance office for real-time squadron financial status. DSS applications include spreadsheets for summarizing and graphing financial data and a financial estimating module to estimate funding requirements to support the current troop training project schedule.

Chief, Training Branch. The Chief of Training is primarily faced with semi-structured decisions. Recommended MIS applications include reports to provide information such as squadron training rosters, personnel availability, project schedules, mobility team assignments, squadron OJT status, and section APR and award suspenses. Primary DSS applications involve a training scheduling module to build master training schedules for all squadron personnel based on training requirements and projected personnel availability.

Recommendations for Development of Specific DSS Applications

A large portion of the decision-making information used by managers in this squadron is fragmented and difficult to obtain, as individual managers capture only the data they need. When provided to others, information usually lacks both the format and level of detail required for effective use. Voluminous information--particularly project status; personnel and equipment status and availability; and training requirements--is captured by many sections in a common effort to accomplish projects and maintain mobility readiness. The large degree to which information should be shared suggests a strong need for an automated management information network system.

Although it was not an original research objective, the results of this research support and validate many of the findings of the 1985 RED HORSE Information Management System (RHIMS) study. While the research results supported the study's recommended applications and general system requirements, it provided little support to the need for an automated interface between RED HORSE squadrons.

A mini-computer based network system, as suggested by the original RHIMS study, should be used to support the applications recommended in the research. This recommendation is based on the high volume of data shared between the various squadron sections, the need for rapid communication and data transfer between squadron managers, and the large data storage capability required to support the suggested applications.

The results of the ROMC analysis (Appendix D) were summarized to determine the general system capabilities required to support the recommended applications:

1. A user-friendly menu-driven system.

2. The ability to extract data rapidly from a wide variety of databases.

3. The ability to support a complex system of user privileges and file protection to allow information to be input by one individual, used by another, and denied to others. This would provide protection and accountability for data supplied to the system while protecting Privacy Act information, such as personal data, from unauthorized use.

4. The capability to easily format reports tailored to the individual manager's decision-making needs by extracting data from master databases without changing the original data.

5. The capability to support new applications or change existing applications as decision needs change. This may be facilitated through easy-to-use programming languages.

6. The capability to interface with host base automated management systems through modems or dedicated lines.

7. The capability to provide graphic representations of data.

8. The capability to store historical data such as project cost, vehicle maintenance histories, and labor utilization, on high volume data storage devices such as disk drives and magnetic tape.

9. The capability to support word processing and electronic mail functions.

The findings generated by this research indicate a complex system of information flows within the RED HORSE squadron. A staged development approach is recommended for developing these MIS/DSS applications. The results of this research should be reviewed by both the users and system designers to establish a concept of operation within which specific prototype applications would be developed. These applications should focus on decision areas that offer a high payoff through automated support. This will provide specific applications to generate user interest and provide a basis for developing other applications.

While it was not an objective of this research to make specific recommendations as to the type of automated equipment that should be obtained for RED HORSE squadrons, the findings indicate sufficient applications to warrant the use of a mini-computer network system.

The existing WANG mini-computers at both squadrons should be used to support the MIS/DSS applications described in this report. The WANG mini-computer is recommended for several reasons. First, the equipment is on hand in both RED HORSE squadrons. However, since the equipment was obtained as excess equipment from other bases, it must be carefully inventoried, and missing or damaged parts must be replaced. Second, the WANG equipment is being purchased as the standard system for Engineering and Services organizations worldwide. Because of this, many applications developed by Base Civil Engineering units could be modified or used directly by RED HORSE squadrons. Furthermore, RED HORSE squadrons could benefit from the interface capabilities, with other base computers, being developed for the WANG based WIMS system (26). Finally, the implementation of the WANG equipment in other Engineering and Services organizations should ease the implementation effort for RED HORSE squadrons, since personnel transferred from BCE squadrons to RED HORSE squadrons would benefit from prior experience with the WANG equipment. Also, technical assistance could be obtained from the MAJCOMS and HQ AFESC, who have extensive experience with the WANG equipment.

System Implementation and Long-term Development

This section will discuss a general strategy for successful implementation of automated management systems for RED HORSE squadrons. Although the specific implementation tasks performed will depend on the type of system chosen, the guidelines presented here should apply to any implementation effort. The recommended strategy was developed by combining strategies recommended by Keen and Morton (28), Alter (2), and Multinovich and Vlanovich (32) into a general strategy directed toward the reduction of the implementation risk factors developed in Chapter 5. The recommended implementation strategy is outlined below:

1. Determine User Needs. In this phase, the RED HORSE organizational environment is examined to determine problems requiring automated support (32:10) and to determine the degree to which users feel a need for an automated system. During this phase, discussions with users help them better conceptualize their decision-making information needs. This aids in developing a clear pre-defined purpose, and reduces the risk of technical design problems. User initiation is established early as individuals are given the opportunity to voice their ideas and make recommendations for automated support. User involvement should be maintained through the implementation process. This serves to improve user acceptance by securing user initiation and involvement.

2. Develop an Implementation Plan. In this phase, a concept of operation is developed that defines the purpose of the system, the application areas, and general capabilities of the system. This provides the written definition of an immediate and visible problem to work on, a

critical factor noted by Keen (28:196). This plan will help users understand the system's impact on them and facilitate their acceptance. Active support and participation by automation experts from HQ TAC and HQ AFESC is required to guide the squadrons in the development of this plan. This plan should address all risk factors affecting successful implementation, and therefore serves to reduce all risk factors.

3. Acquire Required System Support. This phase involves "selling the system to users and top management" (2; 28). Top management support, both at the squadron level and MAJCOM, is required to secure support for resources required to effectively design, install, and implement the system. Top management support provides a clear signal that management supports the effort and helps secure the cooperation and support of users. MAJCOM support helps provide the technical assistance, equipment and funding required to develop, install, and maintain the system.

4. Form an Implementation Team. During this phase a team is formed to monitor the overall development and implementation effort and to improve communication between the system designers and the users. To better integrate the system applications between the various squadron sections, the team should include one representative from each branch and special staff function. It is also recommended that the squadron Deputy Commander serve as chairman of this team to

resolve possible conflict between branches during implementation. The implementation team should attempt to maintain user involvement and keep them informed of the implementation progress, through periodic briefings at staff meetings and Commander's Calls. This strategy helps reduce the problems associated with multiple implementers and multiple users, by providing a focal point for incorporating the interests of all users into the system development effort.

5. Use an Evolutionary Approach. The system should be designed and implemented using an iterative process, with frequent feedback from users to ensure the system satisfies their needs. This will prevent the expenditure of much time and resources developing a system that doesn't work. When introducing the system into the squadron, implementers should be careful not to overwhelm the users with tasks and responsibilities, or cause such a disruption to their activities as to create resentment toward the system. If the system is complex, with many capabilities and applications, it should be introduced in stages.

The simplest applications, such as word processing and electronic mail, should be introduced first. This will provide users with immediate and useful applications and help generate their interest and enthusiasm. Next, databases and small models should be introduced to provide information reports and other MIS applications to improve the flow of decision-making information through the squadron. Since most information is maintained in a manual information system, much time will be required to input data into the system. The implementation team and system technical support personnel should work closely with individual users during this phase to ensure they understand how the information will be used, and to ensure it is accurate and in the correct format. Finally, as users gain more proficiency in the use of the system, and the databases are established, prototype DSS modules should be introduced.

System designers should work with DSS users to design these modules while the MIS applications are being introduced. These prototype DSS modules should provide decision support in "high payoff areas", such as project, design, and training scheduling; and personnel and equipment selection. This will allow users to gain immediate benefits while serving as a starting point for the development of other applications.

<u>6.</u> <u>Institutionalize the System.</u> After the system is introduced into the squadron, specific actions are required to ensure the system meets users' needs. During this phase, training must be provided to all users and system maintainers.

Training should be accomplished in a formal classroom setting, using realistic example problems that the user can relate to. Training manuals should be written from the user's point of view--not the programmer's--and should explain how to use the system instead of how the system was constructed (37:38). Training should emphasize what the system can do for the user, instead of emphasizing rigid requirements for the user to support the system. Finally, care must be taken to avoid overwhelming the trainees with too much documentation at the beginning of the training, or they will become so frustrated that their learning effort will be blocked (37:39). Training courses should be carefully sequenced to meet user needs. Documentation should be written at a level "below the perceived comprehension level of the intended reader" (37:38).

Management should also adopt a policy that encourages voluntary use of the system by allowing users to be creative in the development of new applications or the refinement of existing applications, tailored to meet their individual management style. In other cases management must insist on mandatory use. This is required when "the system is a medium for integration and coordination in planning" (2:169). Mandatory use will most likely be required in maintaining current and accurate personnel, project, equipment, and training data. In these cases, the user's responsibility for data used by the system must be clearly defined.

Recommendations for Further Study

As mentioned in the scope and limitations of Chapter 1, this research did not address the automation needs of a RED HORSE squadron deployed under field conditions. Perhaps critical information could be down loaded from the squadron mini-computer to small micro-computers that could be easily deployed with the deploying mobility team. Future research should address these needs. The methodology used in this research effort could be used to accomplish that objective.

Future researchers should also consider the effect of technology on our automated management systems. Continued research is required to assess technological advances in automated systems and the potential application of that technology to Air Force Engineering and Services. Continued effort is required to develop specific programs to support our managers and their decision support applications.

Finally, future researchers should address the need for evaluating the performance of our automation development efforts to provide feedback for monitoring the implementation process, for better defining future automation requirements, and to provide some "lessons learned" that could be applied to future development efforts.

Appendix A: Interview Questions

1. What are some of the routine decisions you make? How are they made?

2. What are some of the hardest decisions you make? How are they made?

3. What information is most critical to the effective management of your section? How do you use this information?

4. What information must be reported up the chain of command to the Commander or MAJCOM?

5. What things are you currently using the computer to do?

6. What are some decision-making processes that you would like to automate?

7. What information is tracked at the Commander's Update Briefing?

8. What type of things would you like to predict or forecast if you could?

9. What activities in your section would you like to see made more efficient and effective? Why?

APPENDIX B: DATA ANALYSIS OF INFORMATION NEEDS

INFORMATION OR DATA ELEMENT	C C	C D	D O	D O O	D O S	D O P	L G	L G X	L G T	L G S	L G F	D E	D E E	D E P	S E	D A	C C Q	O T	F M
PROJECT TRACKING																			
project number	U	U	U	I	U	U	U	U	U	U		U	U	U		U			U
project title	U	U	U	I	U	U	U	U	U	U		U	U	U		U			U
project description	U	U	U	I	U	U	U	U	U	U		U	U	U		U			U
location	U	U	U	I	U	U	U	U	U	U		U	U	U	U	U	U	U	U
command priority	U	U	U	I			U	U	U	U		U	U						
command approved	U	U	U	I			U			U		U	U						U
project evaluation	U	U	U	U	U	U	U	U	U	U		U	I	U					U
fund status	U	U	U	I			U			U		U	U						I
start/complete date	U	U	U	I	U	U	U	U	U	U	U	U	U	U		U	U	U	U
personnel assigned	U	U	U	U	I	I	U	U	U	U		I	U	U	U	U	U	U	U
equipment assigned	U	U	U	U	U	I	U	U	U	U		U	U						U
design status	U	U	U	U			U					U	I	U					
construction status	U	U	U	I	U	U	U	U		U		U	U	U					U
material status	U	U	U	I	U	U	U	U		I		U	U						U
problem areas	U	U	U	I	U	U	U	U	U	U	U	I	I	U	U	U	U		U

Legend:

I - Section inputs and uses this information
U - Section only uses this information

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
PROJECT DESIGN																			
project engineer	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U	U		U	U
project manager	U	U	U	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
design priority	U	U	U	U			U					I	U	U					
design status	U	U	U	U	U	U	U					I	I	U					U
design hours req'd												U	I	I					
PROJECT PLANNING (CPM & EVALUATION)																			
engr performance standards (EPS)					U	U						U	I	U					
manpower req'd	U	U	U	U	U	U	U	U	U		U	U	I						U
equipment req'd	U	U	U	U	U	U	U	U	U			U	I						U
material req'd (BOM)				I	U	U				U		U	I						U
personnel avail	U	U	U	U	I	I	U	U	I		I	U	U	I		U	U	U	
RH equip avail	U	U	U	U	U	I	U	U	I			U							
host BCE equip avail			U	U	U	U	U	U	U			U	I						
equip depreciation rates									I				U						U
equip fuel consumption data					U	U			I				U						
equip rental rates					U	U							I						U
travel distance			U		U	U							U						I
RH labor shop rate			U	U	U	U						U	U						I
milestones/dates	U	U	U	U	U	U	U	U	U	U	U	I	I	U		U			U

INFORMATION OR DATA ELEMENT	C C	C D	D O	D O O	D O S	D O P	L G	L G X	L G T	L G S	L G F	D E	D E E	D E P	S E	D A	C C Q	O T	F M
PROJECT COST																			
approved funded	U	U	U	I			U					U	U						U
approved unfunded	U	U	U	I			U					U	U						U
project fund code				U			U			U		U	U			U			I
ESP[1] code				U						U		U	U			U			I
per diem expended			U	I									U						U
travel expended			U	I									U						U
equip O&M expended			U	I					U				U						U
fuel expended			U	I					U				U						U
rental equip expended			U	I									U						U
material expended			U	U						I			U						U
RH labor expended			U	I									I	I					U
cost center			U	I						U			U						U
equip depreciation expended			U	I									U						U
planning and design expended			U	U								I	I	I					U
total funded expended	U	U	U	U			U						U	U					I
total unfunded expended	U	U	U	U									U	I					U

[1] Emergency Special Project

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
EQUIPMENT/VEHICLES																			
registration no.	U	U	U	U	U	U	U	U	I	U	U	U	U	U	U				
type	U	U	U	U	U	U	U	U	I	U	U	U	U	U	U				
nomenclature	U	U	U	U	U	U	U	U	I	U	U	U	U	U	U				
assigned shop	U	U	U	U	U	U	U	U	I	U	U	U	U	U	U				
location	U	U	U	I	U	U	U	U	U	U	U	U	U	U	U				
mileage/operating hrs						U	U		I										
scheduled maint due						U	U		I			U							
VDM/VDP[2] status	U	U	U	U	U	U	U	U	I	U	U	U	U						
discrepancy	U	U	U	U	U	U	U	U	I	U	U	U	U						
maint method (IH, base, contract)				U			U		I										
date in				U		U	U		I										
ETIC[3]	U	U	U	U	U	U	U	U	I	U	U	U	U	U	U				
maint work order #							U		I										
parts status							U		I										
TCTO[4] record									I										
vehicles awaiting disposition	U	U		U		U	U	U	I										

[2] Vehicle Down for Maint/Vehicle Down for Parts

[3] Estimated Time in Commision

[4] Technical order compliance record

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
MAINT SUPPLY																			
part #									I	U									
stock #									I	U									
nomenclature									I	U									
unit of issue									I	U									
unit cost									U	I									U
qty on hand									I	U									
location									I	U									
req'd stock level									I	U									
priority									U	I									
fill rate	U						U		U	I									
RDD[5]									I	U									
EDD[6]									U	I									
source of supply									U	I									

[5] Required Delivery Date

[6] Estimated Delivery Date

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
SUPPLY - EQUIP																			
CA/CRL[7] account			U	U	U	U	U	U	U	I	U	U	U	U		U		U	U
stock number			U	U	U	U	U	U	U	U	U	U	U	U		U		U	U
nomenclature			U	U	U	U	U	U	U	I	U	U	U	U		U		U	U
unit of issue			U	U	U	U	U	U	U	I	U	U	U	U		U		U	U
qty on hand			U	I	I	I	U	I	I	U	I	U	I	I		I		I	I
unit cost			U	U	U	U	U	U	U	I	U	U	U	U		U		U	U
serial number (weapons)								U		I								U	
PMEL[8] inspections/ date due				U	U	U			I	U	U			I					
SUPPLY - CLOTHING																			
type bag								U		I									
bag #										I									
mobility position #								I		U									
stock number										I									
nomenclature								U		I									
size								U		I									
quantity req'd							U	U		I									
quantity on hand							U	U		I									
location								U		I									

7 Custodian Authorization/Custody Receipt Listing

8 Precision Measurement Equipment Laboratory

INFORMATION OR DATA ELEMENT	C C	C D	D O	D O O	D O S	D O P	L G	L G X	L G T	L G S	L G F	D E	D E E	D E P	S E	D A	C C Q	O T	F M
WRSK/WRM[9] MANAGEMENT																			
stock #								U	I	I									
part #								U	I	I									
nomenclature								U	I	I									
quantity req'd							U	I	I	U									
quantity on hand							U	U	U	I									
location								U	I	U									
shop/section OPR[10]								I	U	U									

[9] War Readiness Supply Kit/War Reserve Material

[10] Office of Primary Responsibility

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
SUPPLY - REQUISITIONS																			
work order #				I	U	U				U		U	U						U
facility #				I						U									
installation code										I									
org code				U	U	U			U	I	U	U	U	U	U	U	U	U	I
shop code				I	I	I			I	U	I	U	I	I	I	I	I	I	U
stock #				I	I	I			I	U	I	U	I	I	I	I	I	I	I
nomenclature				I	I	I			I	U	I	U	I	I	I	I	I	I	I
unit of issue				I	U	U			U	I	U	U	U	I	U	U	U	U	U
quantity req'd				I	I	I			I	U	I	I	I	I	I	I	I	I	I
est unit cost				U	U	U			U	I	U	U	U	U	U	U	U	U	U
actual cost				U	U	U			U	I	U	U	U	U	U	U	U	U	U
item location				U	U	U			U	I	U	U	U	U	U	U	U	U	U
source of supply										I									U
date ordered				U	U	U			U	I	U	U	U	U	U	U	U	U	U
priority				U	U	U			U	I	U	U	U	U	U	U	U	U	U
req'd delivery date				I	I	I			I	U	I	I	I	I	I	I	I	I	I
est delivery date				U	U	U			U	I	U	U	U	U	U	U	U	U	U
transaction ID #				U	U	U			U	I	U	U	U	U	U	U	U	U	U
custodian request #				I	I	I			I	U	I			I	I	I	I	I	I
date received				U	U	U			U	I	U	U	U	U	U	U	U	U	U

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
TOOL ISSUE																			
stock #					U	U			U	I									
description					I	I			I	U									
name					I	I			I	U									
shop/section					I	I			I	U									
date out					I	I			I	U									
date due-in					I	I			I	U									
date returned					I	I			I	U									
RESIDUAL MATERIALS																			
stock #				U	U	U				I			U						U
nomenclature				U	U	U				I			U						U
unit of issue				U	U	U				I			U						U
quantity on hand				U	U	U				I			U						U
unit cost				U	U	U				I			U						U
location				U	U	U				I			U						U
date received				U	U	U				I			U						U
work order #				U	U	U				I			U						U

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
MOBILITY/READINESS																			
mobility increment #	U	U	U	U	U	U	U	I	U	U	U	U	U	U				U	
nomenclature	U	U	U	U	U	U	U	I	U	U	U	U	U	U				U	
increment manager/alt	U	U	I	U	U	U	I	U	U	U	U	I	U	U		I		U	
responsible shop	U	U	I	U	U	U	I	U	U	U	U	I	U	U		I		U	
mobility position number	U	U	U	U	U	U	U	I	U	U	U	U	U	U		U		U	
team assigned	U	U	I	U	U	U	I	U	U	U	U	I	U	U		U		U	
load list	U	U	U	I	I	I	U	U	I	I	I	U	I	I		I			
weight/cube				I	I	I	U	U	I	I	I	U	I	I					
hazardous cargo data				I	I	I	U	U	I	I	I	U	I	I					
cargo couriers	U	U	U	U	U	U	U	I	U	U	U	U	U	U		U		U	
load plan	U	U	U	U	U	U	U	I	U	U	U	U	U	U					
troop commanders	U	U	U	U	U	U	U	I	U	U	U	U	U	U		U			
cargo restrictions					U	U	U	I	U	U	U	U	U	U					
sensitive cargo	U	U	U	I	I	I	U	U	I	I	I	U	I	I		I			
weapons couriers	U	U	U	U	U	U	U	I	U	U	U	U	U	U		U			

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
FINANCIAL																			
RC/CC[11]	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
EEIC[12]	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
budget authority	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
funded requirement	U	U	I	U	U	U	I	U	U	U	U	I	U	U	I	I	I	I	U
unfunded requirement	U	U	I	U	U	U	I	U	U	U	U	I	U	U	U	I	I	I	U
commitments	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
obligations	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
quarterly targets	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
purchase request #	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
contract #	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
date	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I
Fiscal year	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I

11 Responsibility Center/Cost Center code

12 Element of Expense Investment Code

INFORMATION OR DATA ELEMENT	CC	CD	DO	OO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
INDIVIDUAL PERSONNEL																			
name/rank	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
date of rank	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
date of birth	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
ssan	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
date arrived station	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
projected departure	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
duty section/shop	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
home address/phone	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
marital status	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
dependent info	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
TDY history	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
PERSONNEL MGMT																			
meal card											U					I	U		
security clearance	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
passport								U				U	U			I			
UIF[13]/control roster	U	U	U				U	U				U				U	I		
medical profiles		U	U				U	U				U				I	U		
physical fitness data	U	U														I	U		
position authorizations	U	U	U				U	U				U			U	I	U	U	U
reporting official	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
personnel supervised	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
leave projections	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
ADMINISTRATION																			
OER/APR[14] suspenses	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
additional duties	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
appointments	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
award/decoration suspenses	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
other suspenses	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U	U
TDY order #/date				U			U	U				U				I	U		U
amendment #/date				U			U	U				U				I	U		U
TAC trip # [15]				U			U	U				U				I	U		U
departure date	U	U	U	I	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
est return date	U	U	U	I	U	U	U	U	U	U	U	U	U	U	U	U	I	U	U
mode of departure			I	U	U	U	U	U				U				U	I		U
special authorizations	I	I	U	U	U	U	U	U				U				U	I		U

[14] Officer Effectiveness Rating/Airman Performance Report

[15] Control number from HQ TAC. Only required for over-seas deployments

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
TRAINING																			
type req't	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
frequency	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
personnel requiring training	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
personnel trained	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
date accomplished	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
date due	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
location of training	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	I	
CDC[16] course no.				U	U	U		U	U	U	U		U	U	U	U	U	I	U
start date				U	U	U		U	U	U	U		U	U	U	U	U	I	U
complete date				U	U	U		U	U	U	U		U	U	U	U	U	I	U
test date				U	U	U		U	U	U	U		U	U	U	U	U	I	U

[16] Career Development Course

INFORMATION OR DATA ELEMENT	CC	CD	DO	DOO	DOS	DOP	LG	LGX	LGT	LGS	LGF	DE	DEE	DEP	SE	DA	CCQ	OT	FM
HAZARD/MISHAP REPORTS																			
hazard report #	U	U	U				U		U			U			I	U	U	U	U
type	U	U	U				U		U			U			I	U	U	U	U
submitter	U	U	U				U		U			U			I	U	U	U	U
description	U	U	U				U		U			U			I	U	U	U	U
date received	U	U	U				U		U			U			I	U	U	U	U
date forwarded	U	U	U				U		U			U			I	U	U	U	U
suspense date	U	U	U				U		U			U			I	U	U	U	U
OPR	U	U	U				U		U			U			I	U	U	U	U
mishap report #	U	U	U				U		U			U			I	U	U	U	U
name	U	U	U				U		U			U			I	U	U	U	U
duty section	U	U	U				U		U			U			I	U	U	U	U
AFSC[17]	U	U	U				U		U			U			I	U	U	U	U
age	U	U	U				U		U			U			I	U	U	U	U
sex	U	U	U				U		U			U			I	U	U	U	U
date of mishap/time	U	U	U				U		U			U			I	U	U	U	U
location	U	U	U				U		U			U			I	U	U	U	U
description	U	U	U				U		U			U			I	U	U	U	U
est cost damage	U	U	U				U		U			U			I	U	U	U	U

[17] Air Force Specialty Code

APPENDIX C: KEY DECISION MATRIX

COMMANDER

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT ACTIVITY: MANAGEMENT CONTROL	MANAGEMENT ACTIVITY: OPERATIONAL CONTROL
UN-STRUCTURED	1. What type of projects do do we need for training? 2. Are we developing and maintaining the capabilities required to perform our mission?	1. Where are my problem areas? 2. How is morale? How can it be improved?	1. How is this officer performing?
SEMI-STRUCTURED	1. Which projects should we do this year?	1. How is this branch or section performing? 2. Should I approve this project schedule?	1. Should I allow this individual to re-enlist?
STRUCTURED	1. Are we meeting our goals and objectives?	1. Are we adequately manned, equipped, and trained? 2. What is the squadron's current readiness status?	1. Is this project on schedule? 2. Are we ready to deploy on this project?

DEPUTY COMMANDER

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT ACTIVITY: MANAGEMENT CONTROL	MANAGEMENT ACTIVITY: OPERATIONAL CONTROL
UN-STRUCTURED	1. What type of projects do do we need for training? 2. Are we providing the training and experience our people need for career progression?	1. Is this the best project Manager for this project? 2. How is morale? How can it be improved?	1. Are personnel selected for this project reliable?
SEMI-STRUCTURED	1. How will this project schedule affect our mobility readiness rating? 2. Are our project training and our contingency skill training activities adequately balanced?	1. When can we schedule squadron training as to have the least impact on training projects? 2. Does the projected leave for key people present problems?	1. Are additional duties fairly distributed among our people?
STRUCTURED	1. Are we meeting our goals and objectives?	1. How well are we meeting our training requirements? 2. What is our current combat readiness rating?	1. Is this project on schedule? 2. Are any projects having funding problems?

OPERATIONS BRANCH

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
UN-STRUCTURED	1. What type of projects do do we need for training?	1. Is this the best project Manager for this project?	1. Are personnel selected for this project reliable?
	2. Are personnel receiving adequate training?	2. How is morale? How can it be improved?	
	3. Are we ready to do our mission ?	3. Where are my problem areas?	
SEMI-STRUCTURED	1. Which jobs will we do this year?	1. Am I keeping my men TDY too long?	1. Should we take on this project?
	2. What are my funding requirements for next year?	2. How will this deployment affect our mobility status?	2. Should I grant this leave request?
		3. Are we making the best use of section resources?	
STRUCTURED	1. What people and equipment do we need to accomplish our mission?	1. Am I meeting training requirements for all personnel?	1. what resources do I need for this project? When do I need them?

LOGISTICS BRANCH

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
UN-STRUCTURED	1. What type of equipment and vehicles do we need? 2. Are personnel receiving adequate training?	1. Is this the best project Manager for this project? 2. How is morale? How can it be improved? 3. Where are my problem areas?	1. Are personnel selected for this project reliable?
SEMI-STRUCTURED	1. What are my funding requirements ?	1. Are we providing the support required to accomplish troop training projects? 2. Are we making the best use of our resources?	1. Should we repair this vehicle or submit it for disposition? 2. How will this deployment affect our mobility status?
STRUCTURED	1. What equipment should receive maintenance priority? 2. What people and equipment do I need to accomplish the mission?	1. What is our current rating for combat readiness? 2. What percentage of this requirement have we met?	1. Is this individual deployable? 2. Should we expedite this material order?

ENGINEERING BRANCH

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
UN-STRUCTURED	1. What type of projects do we need for training? 2. Are my engineers and site developers receiving adequate training?	1. Is this the best Engineer for this project? 2. How is morale? How can it be improved? 3. Where are my problem areas?	1. Are personnel selected for this project reliable?
SEMI-STRUCTURED	1. What type of tools and equipment do we need to better do our job? 2. What are my funding requirements ?	1. Can we design this project In-house? 2. Are my personnel all productively employed? 3. Are we making the best use of our resources?	1. Who should I assign as Project Engineer? 2. What manpower and equipment is required for this project? 3. Should I approve this leave request?
STRUCTURED	1. What people and equipment do I need to accomplish my mission?	1. Am I meeting my design schedule?	1. What is my planning and design cost for this project?

SAFETY SECTION

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT ACTIVITY: MANAGEMENT CONTROL	MANAGEMENT ACTIVITY: OPERATIONAL CONTROL
UN-STRUCTURED		1. Where should we put our emphasis?	
SEMI-STRUCTURED	1. What types of safety programs do we need?	1. Do our sections and shops have an effective safety program?	1. Do these accidents indicate an adverse trend?
STRUCTURED			1. What is the status of this accident report?

UNIT ADMINISTRATION

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT ACTIVITY: MANAGEMENT CONTROL	MANAGEMENT ACTIVITY: OPERATIONAL CONTROL
UN-STRUCTURED			
SEMI-STRUCTURED			1. When will this person be available for this appointment?
STRUCTURED		1. Are we meeting OER, APR and award suspenses?	1. What is the status of this suspense?

HEADQUARTERS SQUADRON SECTION

TYPE OF DECISION	MANAGEMENT ACTIVITY		
	STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
UN-STRUCTURED	1. What are our out-year budget requirements? 2. Are we providing the training and experience our people need for career progression?	1. How is the squadron's morale? How can it be improved?	1. What is the best way to handle this personal problem?
SEMI-STRUCTURED	1. Do we have any long-term manning problems.	1. Do we have adverse trends in disciplinary problems?	1. Should we recommend this person for retention or reinlistment?
STRUCTURED		1. Is squadron retention at acceptable levels?	1. Are we meeting the suspenses for OERs, APRs, and awards?

TRAINING SECTION

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT ACTIVITY: MANAGEMENT CONTROL	MANAGEMENT ACTIVITY: OPERATIONAL CONTROL
UN-STRUCTURED	1. What capabilities should we develop?	1. How can we make our training more effective?	
SEMI-STRUCTURED	1. When should this training be conducted?	1. What tasks should be included in this training? 2. Do we have an adverse trend in CDC testing or OJT training?	1. Who should teach this training? 2. Who should I schedule for this training slot?
STRUCTURED	1. How many training quotas do I need for this year?	1. Who should be given priority for this training?	1. What individuals are overdue for this training?

FUNDS MANAGEMENT SECTION

TYPE OF DECISION	MANAGEMENT ACTIVITY: STRATEGIC PLANNING	MANAGEMENT CONTROL	OPERATIONAL CONTROL
UN-STRUCTURED	1. What are our out-year budget requirements?	1. Is this the best way to distribute our funds?	
SEMI-STRUCTURED	1. What are our forecasted fund requirements for the out years?	1. What is my forecasted obligations for the year given our past spending?	1. How should I re-program these funds? 2. What is the expected cost of this project?
STRUCTURED		1. What is our shop labor rate?	1. Is this project over cost?

Appendix D: ROMC Analysis Results

The required DSS capabilities for various decisions were determined by first analyzing each decision in terms of Simon's three stages of decision making, then identifying the ROMC components related to each stage.

DECISION: Considering the affect on mobility team readiness, should I approve this project schedule? (CC, CD, DO)

INTELLIGENCE

- Gather data on projects scheduled for a particular time period

- For each of the above projects, identify the specific personnel and equipment assets scheduled to deploy on the project for each day

- For each individual and each equipment item identify the mobility team assigned

DESIGN

- Summarize data elements

- Plot the total percentage of people available against time for each project with separate graph line representing the total

- Plot the total percentage of equipment available against time for each project with separate graph line representing the total

CHOICE

- Select the mobility team whose mobility status you want to graph

- Select for removal a project that has the greatest impact on mobility team readiness

- Chose other alternative project schedules to plot

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects
- Lists of personnel and equipment for each project
- Graphs of assets available versus time

OPERATIONS

- Query the data base
- Extract and combine elements from multiple databases
- Summarize statistics for the data
- Plot graphs
- Print tables or graphs

MEMORY AIDS

- Extracted data on projects
- Work space for saving information displayed
- Databases

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages

DECISION: Can we design this project In-house? Who should I assign as Project Engineer? How should I assign engineers to this design effort? (DE, DEE)

INTELLIGENCE

- Review current design schedule

- Review Troop Training Project schedule for individual project start date, completion date, and priority

- Review availability of each engineer using leave and TDY schedules

- Define major activities and manhours required for each project

- For each engineer, determine his skill (Civil, Electrical, etc.), the percent of time available for design, and his relative efficiency

DESIGN

- Starting with the highest priority project, assign individuals based on their skill, availability , and efficiency

- Compute activity start and completion dates based on design hours required for each activity, the percent of the time the individual is available for design, and his efficiency

- Adjust availability information for each individual as he is scheduled

- Repeat for next highest priority project, then the next, until all projects are scheduled

- Display recommended design schedule

CHOICE

- Manually choose individual engineers to be assigned to specific projects or activities

- Select new activity start and completion dates

- Update current design schedule, delete this analysis, or perform new analysis

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects and their status information
- Lists of personnel, their skill, and availability
- Gantt chart for displaying design schedules
- Screen forms for data entry

OPERATIONS

- Query multiple databases
- Extract and combine elements from multiple databases
- Select individual for task based on predetermined decision rules
- Update engineer availability to reflect each task assigned
- Compute start and completion dates for each task
- Plot Gantt Charts
- Print tables or charts

MEMORY AIDS

- Extracted data on projects, design requirements, and engineer availability
- Work space for saving information displayed
- Databases for maintaining design schedule

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages

DECISION: How should we distribute squadron obligation authority? What are our quarterly fund requirements? (FM)

INTELLIGENCE

- Review budget request from each branch

- Review project schedule

- Review funds required to support each project

DESIGN

- Divide projects according to the fiscal quarter in which they will be accomplished

- Total the funds required for all projects in each quarter by EEIC

- Total the funds required for all branches in each quarter by EEIC

- Add funds required to support training projects to funds required by each branch

- Graph funds required for each quarter by EEIC

CHOICE

- Select line item from branch budget request or project fund requirement for change

- Select another time period for analysis

- Select information to be displayed, printed, or graphed

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Display Branch Budget request documents

- On-screen Data entry forms

- Lists of projects

- Lists of funds required for each project

- Graphs of planned versus actual expenditures

OPERATIONS

- Query multiple databases

- Sort projects by data

- Summarize cost data for projects by time period

- Combine cost data from multiple databases

- Plot graphs

- Print tables or graphs

MEMORY AIDS

- Extracted project cost data

- workspace for saving information displayed

- source databases for project scheduling and cost data

- source databases for Branch and project fund expenditures

CONTROL MECHANISMS

- Mark and bound key to highlite displayed data

- Menus and function keys

- Help screens and error messages

- Flashing data fields to indicate incomplete data or data that needs updating

DECISION: What stock levels should we establish for our War Readiness Spares Kits (WRSK)? (LGT)

INTELLIGENCE

- Examine historical data from maintenance work order files

- Examine current WRSK inventory data

- Examine type and number of vehicles and heavy equipment items assigned to each mobility team

- Estimate the mileage or hours of operation for each type of equipment on each mobility team

DESIGN

- Determine the parts used and vehicle type, registration number, and mileage or operation hours for each vehicle or heavy equipment item

- Total the number of each type part required for each vehicle and its total mileage or operation hours

- Compute failure rate for each part based on mileage or operation hours

- Compute expected quantity of parts required by part number and vehicle or equipment type for each mobility team

- Display results

CHOICE

- Select time period for analysis

- Change estimates of mileage or operation hours for each vehicle

- Select data to be printed, saved, or deleted

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of part numbers, stock numbers, quantity on hand, and quantity required
- On screen data entry forms
- Parameters to be selected in performing an analysis

OPERATIONS

- Extract data from multiple databases
- Sort extracted data
- Compute part consumption rates based on historical consumption data and mileage or operating hours
- Save resulting information
- Compute required stock levels for time period selected

MEMORY AIDS

- Archived databases on tape or other mass storage devices
- Result databases
- Workspace for storing displayed information

CONTROL MECHANISMS

- Mark and bound key to highlite displayed data
- Menus and function keys
- Help screens and error messages
- Flashing data fields to indicate incomplete data

DECISION: Who should I assign to this project crew? (DOS, DOP)

INTELLIGENCE

- Review project requirements
- Review personnel availability
- Review training schedule
- Review individual personnel TDY history

DESIGN

- List personnel available during project timeframe
- Search training database for each individual listed to determine and list all training conflicts
- Search personnel database for each individual to determine and list all required personnel actions and appointments
- Display individuals selected, their last TDY, duration, and total number of days TDY in last 12 months
- Update personnel database to reflect availability status for individuals selected

CHOICE

- Select time period for analysis
- Select search parameters (AFSC, name, shop assigned)
- Select individual for assignment to project

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects, personnel required, personnel available, training and appointment conflicts
- Search parameters for selecting type of analysis

OPERATIONS

- Query the multiple databases
- Extract data subsets from multiple databases
- Search for matching parameters
- Display lists
- Print lists
- Update databases

MEMORY AIDS

- Extracted data on projects
- Extracted data on personnel
- Work space for saving information displayed
- Databases

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages
- Functions to "Highlite" or mark selected data

DECISION: Considering that possible changes in a project start date may cause deployed personnel to miss scheduled training, should I approve this project crew list? (CC, CD, DO)

INTELLIGENCE

- Select a project from the project schedule

- Gather data on individuals scheduled for this project

- User specifies a time period for the sensitivity analysis (. number of days for early start, +n, or number of days for late start, -n)

DESIGN

- Adjust each persons scheduled deployment period by the number of days specified for the analysis

- Search master training database for scheduled training required by each individual for the adjusted deployment period

- Display resulting data by individuals name, type training, and date required

CHOICE

- Select individual for replacement

- Insert name of alternate individual for assignment consideration and repeat the analysis

- Select another time period for analysis

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects

- Lists of personnel scheduled for each project

- Lists of training conflicts

OPERATIONS

- Query the data base
- Extract data subsets from multiple databases
- Search for matching parameters
- Display lists
- Print lists

MEMORY AIDS

- Extracted data on projects
- Extracted data on personnel
- Work space for saving information displayed
- Databases

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages
- Functions to "Highlite" or mark selected data

DECISION: What equipment and vehicles should we deploy? What vehicles should we borrow or rent? (PE, DO, DOP)

INTELLIGENCE

- Review vehicles and equipment required to support the project and the time period in which they will be required

- Review availability of RED HORSE equipment and vehicles

- Review availability of equipment at deployed location

DESIGN

- List the RED HORSE equipment projected to be available for the time periods specified

- List the type of equipment normally available from the BCE or by local rental at the project location

- Compute the estimated cost of deploying and operating RED HORSE equipment listed above

- Compute estimated rental cost for this same type equipment

- Capture this information and save for use in project evaluation

CHOICE

- Select RED HORSE equipment for project deployment

- Choose different time periods for analysis to investigate feasibility of changes in the construction schedule

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects, equipment requirements, cost data

- Lists of equipment available by type and time period

- On screen data entry forms

OPERATIONS

- Query multiple databases
- Extract and combine data from multiple databases
- Cross check selected equipment for availability
- Compute cost of deploying equipment and cost of renting equipment based on distance and operating hours

MEMORY AIDS

- Extracted data on equipment available
- Extracted cost data
- Work space for saving information displayed
- Databases for maintaining equipment and cost data

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages
- Functions to "Highlite" or mark selected data

DECISION: When should this project be scheduled? (DOO, DO, DE, CD)

INTELLIGENCE

- Review current project schedule
- Examine project to be scheduled for priority and desired start and completion dates
- Determine manpower required by shop for each day from CPM
- Determine equipment required by type for each day from CPM
- Review personnel and equipment availability

DESIGN

- Add the project's manpower requirements to the current schedule and list projected shortages by shop and time period
- Add the project's equipment requirements to the current schedule and list projected shortages by equipment type and time period
- Repeat this process using different manpower and equipment requirements and different time periods
- Update master schedule from this analysis

CHOICE

- Select time period for project start
- Select project to be scheduled
- Select parameters to be modified (number of personnel required, dates required, etc.)
- Choose feasible solution to be used to update master schedule

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of projects, dates, personnel, and equipment requirements
- Lists of manpower and equipment available
- Lists of projects scheduled, priority, estimated start and completion dates

OPERATIONS

- Extract project requirements from project planning database
- Extract personnel and equipment availability data
- Combine data fields and display results
- Update source databases with new project schedule, personnel, and equipment availability

MEMORY AIDS

- Extracted data on projects, personnel, and equipment
- Work space for saving information displayed
- Databases for maintaining source data

CONTROL MECHANISMS

- Menus and function Keys
- Help Screens and error messages
- Functions to "Highlite" or mark selected data

DECISION: When should this training requirement be conducted? How many quotas do I need for this class? Who should I schedule for this training? (OT)

INTELLIGENCE

- Review training database

- Review personnel availability

DESIGN

- For each training requirement, list number of individuals due training each month

- Sort above list by date training required

- For each training type and class date, list individuals requiring training

- Search for personnel available for each training session

CHOICE

- Select dates for training to be conducted

- Select individuals for each training session

Summarizing the above in terms of the ROMC components, we identify the following the following required DSS capabilities:

REPRESENTATIONS

- Lists of training requirements

- Lists of personnel available for training

- On screen data entry forms

OPERATIONS

- Search master training database and extract individuals requiring training

- Sort extracted database by type training required and time period

- Search personnel personnel availability database and display individuals available for each class date

- Display master training schedules

- Update databases

MEMORY AIDS

- Extracted data on training requirements, personnel availability, and training schedules

- Work space for saving information displayed

- Databases for maintaining source data

CONTROL MECHANISMS

- Menus and function Keys

- Help Screens and error messages

- Functions to "Highlite" or mark selected data

- Flashing data fields to indicate incomplete data or data that requires updating

Bibliography

1. Alexander, Milton J. Information Systems Analysis: Theory and Applications. Chicago: Science Research Associates, 1974.

2. Alter, Steven L. Decision Support Systems: Current Practices and Continuing Challenges. Reading MA: Addison-Wesley Publishing Company, 1980.

3. Barre, SMSgt Robert M., Superintendent, Airfields Flight. Telephone interview. 820th CES(HR)/DOE, Nellis AFB NV, 13 July 1987.

4. Bennie, Capt Stewart D., Director of Engineering. Personal interview. 823rd CES(HR)/DE, Hurlburt Field FL, 24 April 1987.

5. Benton, 1Lt Douglas W., Project Engineer. Telephone and personal interviews. 823rd CES(HR)/DEE, Hurlburt Field FL, 9 March through 24 April 1987.

6. Bolin, SMSgt David and John Mimms. "RED HORSE Information Management System (RHIMS)," Study and Program Objective Memorandum (HAF-F87-01). HQ AFESC/DEOP, Tyndall AFB FL, 15 May 1985.

7. Bowen, CMSgt Herman T., Program Manager, Directorate of Readiness. Telephone interviews. HQ AFESC/DEO, Tyndall AFB FL, 3 February through 24 June 1987.

8. Bradley, TSgt William A., Squadron Safety Manager. Personal interview. 823rd CES(HR)/SE, Hurlburt Field FL, 24 April 1987.

9. Broad, Maj Paul T., Director of Logistics. Telephone interviews. 823rd CES(HR)/LG, Hurlburt Field FL, 15 June through 14 July 1987.

10. Campbell 1Lt David W., Chief of Training. Personal interview. 823rd CES(HR)/OT, Hurlburt Field FL, 23 April 1987.

11. Caywood, Capt Richard C., Director of Engineering. Telephone interview. 820th CES(HR)/DE, Nellis AFB NV, 6 July 1987.

12. Cirrilo, Lt Col Francis A., Commander. Personal Interview. 823rd CES(HR)/CC, Hurlburt Field FL, 24 April 1987.

13. Collins, CMSgt Truluck, Deputy Chief of Operations. Telephone interview. 823th CES(HR)/DO, Hurlburt Field FL, 3 February through 12 April 1987.

14. Combs, Maj Doyle F., Informations Systems Staff Officer. Telephone interviews. HQ AFESC/SI, Tyndall AFB FL, 9 February through 27 July 1987.

15. Coullahan, Maj Patrick M. "U.S. Air Force work Information Management System (WIMS)." Unpublished Paper. HQ AFESC, Tyndall AFB FL, 1984.

16. Decker, 1Lt William G., Chief of Logistics Plans. Personal interview. 823rd CES(HR)/LGX, Hurlburt Field FL, 23 April 1987.

17. Department of the Air Force. Civil Engineering RED HORSE Squadrons. AFR 93-9. Washington: HQ USAF, 15 April 1983.

18. Department of the Air Force. Management of Training Projects Civil Engineering RED HORSE Squadrons. TACR 85-3. Langley Air Force Base VA: Headquarters Tactical Air Command, 9 November 1984.

19. Department of the Air Force. Project Managers Handbook. 823rd CES(HR)/DE, Hurlburt Field FL, March 1986.

20. Dycus, CMSgt Robert L., Chief of Supply. Telephone interview. 820th CES(HR)/LGS, Nellis AFB NV, 6 July 1987.

21. Fletcher, CMSgt James A., Chief of Vehicle Maintenance. Telephone interview. 820th CES(HR)/LGT, Nellis AFB NV, 14 July 1987.

22. Florence, MSgt Joe L., Chief of Administration. Telephone Interview. 823rd CES(HR)/DA, Hurlburt Field FL, 30 July 1987.

23. Flores, TSgt Joe, Superintendent of Services. Telephone interview. 820th CES(HR)/LGF, Nellis AFB NV, 23 July 1987.

24. Folle, TSgt Richard M., Funds Manager. Telephone interview. 820th CES(HR), Nellis AFB NV, 8 July 1987.

25. Gilmore, Capt Craig P., Squadron Section Commander. Telephone and personal interviews. 823rd CES(HR)/CCQ, Hurlburt Field FL, 24 April through 8 July 1987.

26. Goodman, Capt Timothy M., Information Systems Staff Officer. Telephone interview. HQ AFESC/SIX, Tyndall AFB FL, 24 June 1987.

27. Hall, MSgt Waldon L., Funds Manager. Telephone and personal interviews. 823rd CES(HR), Hurlburt Field FL, 24 April 1987.

28. Keen, Peter G.W. and Michael S. Scott Morton. Decision Support Systems: An Organizational Perspective. Reading MA: Addison-Wesley Publishing Company, 1978.

29. McDaniels, Lt Col Harry R., Commander. Telephone interview. 820th CES(HR)/CC, Nellis AFB NV, 6 July 1987.

30. Menkus, Belden. "Practical Considerations in Decision Support System Design," Journal of Systems Management, 34: 32-33 (June 1983).

31. Moore, Capt Murdock, Vehicle Maintenance Officer. Telephone and personal interviews. 823rd CES(HR)/LGT, Hurlburt Field FL, 23 April 1987.

32. Multinovich, Jugoslav S. and Vladimir Vlahovich. "A Strategy for Successful MIS/DSS Implementation," Journal of Systems Management, 35: 8-15 (August 1984).

33. Munro, Malcolm C. "Determining the Manager's Information Needs," Journal of Systems Management, 29: 34-39 (June 1978).

34. Pedigo, MSgt Ryan, Chief of Administration. Telephone and personal interviews. 823rd CES(HR)/DA, Hurlburt Field FL, 23 through 29 April 1987.

35. Prosise, Lt Col William A., Commander. Telephone interview. 203rd CES(HR)/CC (ANG), Virgina Beach VA, 23 June 1987.

36. Raedeker, Capt Robert C., Chief of Logistic Plans. Telephone interviews. 820th CES(HR)/LGX, Nellis AFB NV, 18 June through 4 August 1987.

37. Rector, Robert L. "Decision Support Systems: Strategic Planning Tools," Managerial Planning, 31: 36-40 (May-June 1983).

38. Rees, 1Lt Randall J., Chief of Design. Telephone interview. 823rd CES(HR)/DEE, Hurlburt Field FL, 30 July 1987.

39. Ryburn, Maj James T., Director of Operations. Telephone and personal interviews. 823rd CES(HR)/DO, Hurlburt Field FL, 3 February through 23 April 1987.

40. Salomon, Maj Roy K., Director of Operations. Telephone interview. 820th CES(HR)/DO, Nellis AFB NV, 15 July 1987.

41. Schaal, Lt Col William E., Deputy Commander. Telephone and personal interviews. 823rd CES(HR)/CD, Hurlburt Field FL, 10 March through 7 July 1987.

42. Sprague, Ralph H. and Eric D. Carlson. Building Effective Decision Support Systems. Engelwood Cliffs New Jersey: Prentice-Hall, 1982.

43. Warren, CMSgt Ervie, Chief of Supply. Personal interviews. 823rd CES(HR)/LGS, Hurlburt Field FL, 23 through 24 April 1987.

44. Waters, CMSgt Carl E., Chief of Vehicle Maintenance. Telephone interview. 823rd CES(HR)/LGT, Hurlburt Field FL, 8 July 1987.

45. Weigel, TSgt Charles P., Operations Center Scheduler. Telephone interviews. 823rd CES(HR)/DOO, Hurlburt Field FL, 9 February 1987.

46. Westmoreland, TSgt Bernard, Unit Training Manager. Telephone interview. 820th CES(HR)/DT, Nellis AFB NV, 14 July 1987.

47. Wilfork, SMSgt Ellis, Operations Center Superintendent. Personal interview. 823rd CES(HR)/DOO, Hurlburt Field Fl, 24 April 1987.

48. Wypiszynski, Maj Steven W., Information Systems Staff Officer. Telephone interview. HQ TAC/DEC, Langley AFB VA, 9 February 1987.

Vita

Captain Arvil E. White was born 10 January 1956 in Bainbridge, Georgia. He graduated from Bainbridge High School in 1974 and attended Auburn University, graduating with a Bachelor of Science Degree in Mechanical Engineering in 1978. Upon graduation, he received a commission in the USAF through the ROTC program. He entered active duty in November 1978, and was assigned to the Directorate of R&D Civil Engineering, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, as a design engineer and program manager. He also served as Director of Operations, 823rd Civil Engineering Squadron Heavy Repair (RED HORSE) at Hurlburt Field, Florida, and as Director of Engineering and Services, Sondrestrom AB, Greenland until entering the School of Systems and Logistics, Air Force Institute of Technology, in May 1986. Upon graduation, he will be assigned to the Directorate of Engineering and Services, Headquarters Tactical Air Command, Langley AFB, Virginia.

Permanent address: Rt 5, Box 1040
Bainbridge, GA 31717

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LYNN E. WOLAVER
Dean for Research and Professional Development
Air Force Institute of Technology (AU)
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This study identifies various Management Information System (MIS) and Decision Support System (DSS) applications for USAF Civil Engineering Rapid Engineer Deployable, Heavy Operational Repair Squadron, Engineer (RED HORSE) squadrons, by analyzing the decision-making information needs of managers in these squadrons.

The results of interviews with managers in two RED HORSE squadrons, as well as a review of regulations and policy material, provided the data for this study. Data and Decision Analysis techniques were used to determine the decision-making information needs of various managers in the squadron. Descriptive and normative models of key decision processes were used to identify potential MIS/DSS application areas. Key decisions were analyzed to identify the automated system capabilities required to support these decisions. Finally, a risk assessment of the system implementation environment was used to identify potential barriers to system implementation.

The research findings indicate the primary MIS applications are reports of personnel, equipment, and vehicle availability; training schedules; project status; and readiness status to the different managers involved in the two major squadron activities—accomplishing troop training projects, and maintaining combat readiness. Several DSS applications are recommended to provide managers with support in scheduling training projects, scheduling individuals for training and project deployments, and forecasting funds or material requirements. A six-step implementation strategy is also presented to improve user acceptance and facilitate the integration of applications between users.

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